BOYER'S SURGERY.

A

TREATISE

ON

SURGICAL DISEASES,

AND THE

OPERATIONS SUITED TO THEM.

BY BARON BOYER,

Member of the Legion of Honour, Professor of Surgery of the Faculty of Medicine of Paris,
Principal Adjunct Surgeon of the Hospital de la Charité, Member of several
National and Foreign learned Societies, &c. &c.

TRANSLATED FROM THE FRENCH
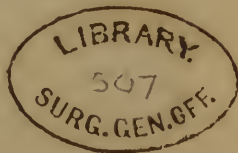
BY ALEXANDER H. STEVENS, M. D.

Professor of the Principles and Practice of Surgery in the Medical Institution of New-York,
and of Queen's College, New-Jersey ; one of the Consulting Physicians
of the New-York Dispensary, &c.

WITH NOTES, AND AN APPENDIX,

BY THE TRANSLATOR.

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Southern District of New-York, ss.

BE IT REMEMBERED, That on the eighteenth day of June, in the fortieth year of the Independence of the United States of (L. S.) America, *Alexander H. Stevens,* of the said District, hath deposited in this office the title of a book, the right whereof he claims as Proprietor, in the words and figures following, to wit : " A Treatise on Surgical " Diseases, and the Operations suited to them. By Baron Boyer, Member of the " Legion of Honour, Professor of Surgery of the Faculty of Medicine of Paris, " Principal Adjunct Surgeon of the Hospital de la Charité, Member of several " National and Foreign learned Societies, &c. &c. Translated from the French by " Alexander H. Stevens, M. D. Professor of the Principles and Practice of Surgery " in the Medical Institution of New-York, and of Queen's College, New-Jersey; " one of the Consulting Physicians of the New-York Dispensary, &c. With Notes, " and an Appendix, by the Translator. Vol. II."

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THERON RUDD,
Clerk of the Southern District of New-York.

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CHAPTER I.

Of Fractures in general.

FRACTURE is a division, or solution of continuity in one or more bones, produced commonly by the violence of some external cause, and sometimes by the forcible and sudden contraction of muscles. In treating of fractures in general, we shall consider successively, and in as many separate articles : 1st. Their differences ; 2d. Their causes ; 3d. Their signs ; 4th. Their prognosis ; 5th. Their treatment ; 6th. The formation of callus.

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ARTICLE I.

Of the Differences of Fractures.

The differences of fractures relate to the bone affected ; to the part of the bone fractured ; to the direction of the fractures ; to the respective position of the fragments ; and, lastly, to the circumstances which attend and render them simple or complicated. Let us examine in detail these five kinds of differences.

1st. In relation to the bone affected : Sometimes fractures affect large bones, as the scapula and the sternum ; sometimes a short bone, as the os calcis ; but most frequently the long bones. The situation of the large bones, and the functions they fulfil, render their fractures very uncommon, if we except the bones of the cranium, which are very frequently fractured. But these fractures do not deserve the attention of the surgeon so much on account of the solution of continuity, as on account of the affection of the brain, or the sanguineous effusion that accompanies them. Fractures of the short bones are more rare, because these bones, in consequence of the almost equal extent of their three dimensions, make greater resistance to

external powers: moreover, these bones, by their situation, or by the nature of their functions, are very little exposed to the action of external causes; and unless the limb be crushed to pieces, fractures of short bones almost always depend on muscular action; which is the most frequent cause of fracture of the patella, of the olecranon, and of the os calcis. The long bones, which serve as supporters or levers, are most exposed to fractures; therefore our remarks on fractures in general will be principally applicable to those of the long bones.

2d. In relation to the point or place of fracture: Bones may be fractured at different points of their length. The fracture most commonly takes place in their middle part, and then they are broken like a stick which is bent beyond its extensibility by two hands placed at its ends. Sometimes, however, the fracture happens nearer the extremity of the bone, and in that case it is always more dangerous, as we shall explain in speaking of the prognostic. Sometimes the bone is fractured in different parts of its length: this double fracture is produced, at times, by two different causes, which have acted successively or simultaneously upon the different parts of the bone, or by the same cause which has acted at the same moment upon different points of its length. These distinctions of fractures, which relate to the parts they occupy, are not mere scholastic subtilities; they have a very great influence upon the prognostic and treatment, as we shall see hereafter.

3d. In relation to the direction of the fracture: A bone may be broken in different ways, and the fracture receives various names, according as its direction is different. In relation to the axis of the bone: It is transverse when the bone is divided by a rupture perpendicular to its length; oblique when the division of the bone is not perpendicular to its length, but removed from it more or less upon one side or the other, which renders the surface of the fracture greater, and causes greater difficulty in keeping together the broken fragments of the bone. Oblique fractures differ from one another according to their greater or less obliquity; according as they are oblique in their whole extent, or partly oblique and partly transverse. A fracture is complicated when the bone is broken in different parts, and divided into a great number of pieces; for then the soft parts are more or less injured.

Many authors have admitted another kind of fracture: for that which is said to happen parallel to the length of a long bone. Duverney, who does not doubt the possi-

bility of this fracture, mentions three cases of it in his Treatise on the Diseases of the Bones, vol. i. page 167.— J. L. Petit believes this kind of fracture imaginary : he gives a very good reason for it ; he says, " There are no blows capable of fracturing a bone longitudinally, which would not have fractured it obliquely, or transversely, with a great deal of ease. Besides, supposing that this fracture might really exist, it would be impossible to dis-cover it upon the living body through the thick contused parts which cover the bones, and to distinguish its effects from those of simple contusion of the bone." The opinion of J. L. Petit has prevailed, and practitioners now regard a longitudinal fracture of the great bone of the limbs, as impossible. We find, however, after gun-shot wounds, the bones split lengthwise, even into their articulations : but these examples do not prove the possibility of simple longitudinal fracture. Whatever be the direction of a fracture, the division always extends throughout the thick-ness of the bone, which is completely separated into two parts ; so that the distinction of fractures into complete and incomplete, admitted by many authors, is not well founded, since the bones are entirely broken : it never happens that their continuity is preserved in part by means of some bony portion that has not suffered division. The elasticity of the bones, and the prompt and sudden causes which fracture them, do not permit them to be broken thus in-completely, or only in one part of their thickness.

4th. It is of very great importance to known the dif-ferent positions of the fragments, since the treatment con-sists almost entirely in remedying or in preventing these derangements. Nevertheless, we must not think that the displacement of the fragments is an absolutely essential symptom ; for we very rarely meet with it in members composed of two bones, when only one of them is fractur-ed ; neither does it happen in all fractures of the necks of bones, as we see certain fractures of the cervix femo-ris, whose fragments are not separated until the person attempts to walk, or imprudently moves the limb. We like-wise see fractures of the leg, in which there exists nei-ther displacement of the fragments, nor alteration in the form of the limb, especially when the tibia alone is frac-tured near its superior extremity, where it is very thick : then the corresponding surfaces of the fragments, having considerable extent, separate with difficulty, if at all ; and, besides, the fibula resists the action of causes which tend to effect a displacement. But when the two bones of the

leg, or forearm are fractured at the same time, displace-
ment usually happens, as in fractures of limbs formed
only of one bone, in consequence of the small extent of the
surfaces of the fragments, and of the great number of
muscles that tend to displace them. Let us now examine
in what directions the fragments can be displaced, and
what are the causes of this displacement : the displace-
ment can take place according to the thickness of the bone,
its length, its direction, and its circumference.

According to its thickness : In transverse fractures only
do we observe this kind of displacement, and then the two
fragments touch each other in some point of their sur-
faces, or they are entirely separated from each other ; in
which last case, the limb is shortened by the riding of
the fragments that slide up by the sides of each other.

According to its length : This mode of displacement, in
which the fragments of the fractured bone ride more or
less upon one another, takes place in oblique fractures ;
and even in transverse fractures, when the displacement,
according to its thickness, has been such, that the surfaces
of the fragments do not correspond. We shall see, in the
end, that, whenever there is a shortening of the limb in
fractures of the extremities, it is the inferior fragment
that is displaced. We may class in the mode of displace-
ment, of which we are speaking, that which happens in
fractures of the patella, of the olecranon, and of the os
calcis ; but this last differs from the others in this, the
fragments, instead of riding one upon the other, are sepa-
rated according to the length of the bone, and remain
separated by a more or less considerable interval.

According to the direction of the bone : In this kind of
displacement, the two fragments form an angle more or
less projecting, and the bone appears curved. We observe
this displacement principally in comminutive fractures : it
sometimes happens in simple fractures ; for example, in
the leg, when the member not resting upon an exact
horizontal plane, the heel is lower than the rest of the leg ;
then the angular projection of the fragments is anterior :
it would have been posterior, if the heel had been too much
elevated.

According to the circumference of the bone : This dis-
placement happens when the inferior fragments receive
a rotatory motion, while the superior remains unmoved,
as in the fractures of the cervix femoris ; if the foot be
badly secured by the apparatus, its weight, joined to that
of the legs and muscular action, draws it outwards, and

causes the inferior fragment to turn in this direction. Be-
sides, the simple displacements of which we have just
spoken, there are compound ones; viz. those which hap-
pen in several directions at the same time ; such for ex-
ample, as that which we observe in a fracture of the os
femoris, when the inferior fragment being drawn inwards,
the point of the foot is inclined outwards.

What are the causes of displacement ? The bones, pas-
sive organs of our movements, have not in themselves any
power capable of producing displacement; but they are
obedient to the impulse of exterior bodies, to the weight of
the member, and to muscular action,—three causes of the
displacement of fractures, which we shall successively ex-
amine. The displacement may be produced by an external
power, either at the moment in which the fracture hap-
pens, and by the action even of the fracturing cause, or
by the weight of the body, when the fracture precedes the
fall, or by any other external cause which acts upon the
fragments, at a shorter or longer period after the bone has
been broken.

The external force, which produces a fracture, acts,
sometimes, upon the place where the bone breaks ; some-
times upon parts more or less distant from the fracture.
In these cases, the action of this force is not entirely em-
ployed in producing the solution of continuity ; it is spent
in causing the displacement of the fragments. Falls are
the most common causes of fractures ; but sometimes the
fall does not take place until after the leg or thigh is
broken ; then the weight of the body produces the dis-
placement, by pushing the superior fragment against the
flesh, which it tears more or less. This happened to Am-
brose Paré. This celebrated surgeon received a kick from
a horse, and in order to avoid a repetition of the blow,
immediately fell down, and the two bones of the left leg,
which were broken, not only pierced the skin, but like-
wise the stocking and boot. I have seen a case almost
similar, in a young man of twenty years old, who, while
standing up, received upon the middle part of his right
thigh, a blow from the shaft of a carriage, which fractur-
ed the femur. The weight of the body not being sup-
ported by this thigh, he fell down ; and, in his fall, the su-
perior fragment not only pierced the muscles and the skin,
but likewise his breeches. The weight of a limb may
cause displacements according to the direction or circum-
ference of the bone, as we have already said. The move-
ments given to a limb in lifting up the person, and in trans-

porting him to his bed, sometimes change the relation of the fragments, and occasion their displacement. But of all causes of the displacement of fractures, the most common and powerful is muscular action. Amongst the muscles which surround a fractured bone, some are attached to its whole length, and hold equally to both fragments ; some arise from the bone above, and are inserted into that which is articulated with the inferior fragment, or into the fragment itself ; others which come from a point more or less distant, terminate in the superior fragment. The muscles that surround the os femoris, furnish us examples of these three dispositions : the triceps adductor is attached to the whole length of the bone ; the biceps, the semi-membranosus, the semi-tendinosus, arise from the pelvis, and are inserted into the leg, with which the inferior fragment is articulated, and whose movements it follows ; the great adductor is inserted into this fragment itself, and the iliacus, the psoas, the pectineus, &c. arise from the loins and pelvis to be inserted into the femur, not far from its superior extremity. The muscles that are attached to the two fragments, contribute very little to their displacement ; they may, however, draw them both toward the side to which they are attached, and thus change the direction of the limb. The triceps adductor, especially its middle part, acts in this manner after fracture of the os femoris, and renders the thigh convex anteriorly. The coraco-brachialis tends to produce the same effect, when the humerus is fractured below its middle. But it is principally to the muscles attached to the inferior fragment, or to the limb with which this fragment is articulated, that we must attribute the displacement. If the humerus were fractured between its superior extremity and the insertion of the pectoralis major, this muscle, aided by the longissimus dorsi, and the teres major, would draw inward the inferior fragment, and displace it by carrying it to the external side of the superior fragment, which remains immoveable, in consequence of its shortness, and because nothing provokes the action of the muscles inserted into it. In fractures of the neck of the femur, the superior fragment, shut up in the acetabulum, has no muscles attached to it : those that are attached to the inferior fragment, draw it upward and backward ; and displacement in this direction is unavoidable. In every fracture, the inferior fragment following the movements of the member with which it is articulated, the muscles which are inserted into the bones of this limb, be-

come very powerful causes of displacement : thus, after fracture of the femur, the biceps, the semi-membranosus, and semi-tendinosus, draw the leg, and, with it, the inferior fragment, upward, inward, and backward, and cause it to ascend upon the internal and posterior side of the superior fragment, whose extremity then projects to the anterior and external side. In fracture of the leg, the gastroc- nemii, the solæi and peronei, by acting upon the foot, draw the inferior fragment of the tibia and fibula, and cause it to slide along the external and posterior side of the superior fragment : for in this, as in all other cases, the strongest muscles cause the displacement, by drawing towards them the inferior fragment upon which they act; and as the posterior muscles of the leg are more numerous and stronger than those of the anterior part, and as those of the external part are not counterbalanced by any muscle, the displacement takes place backward and out- ward. We can then, by supposing a fracture in any point of a long bone, determine *a priori,* from our anatomical knowledge of the muscles, in what direction the displace- ment ought to take place, if no resistance be opposed to the muscular action, and the displacement depend solely upon this cause.

Sometimes the muscles that are attached to the superior fragment alone, are sufficient to displace it. In fracture of the femur, just below the great trochanter, the psoas and iliacus muscles draw forward the end of the superior fragment, which lifts up the skin, and forms towards the bend of the groin a more or less considerable projection : but we must observe that, in general, displacement of the superior fragment is very rare ; the inferior fragments alone is put out of its place.

The manner in which the displacement of fractures takes place by the action of the muscles, explains a phenomenon that usually accompanies them, and which is particularly observed in fractures of the femur, of the clavicle, and of the leg. viz. the projection of the superior fragment, or that which is nearest the trunk. We should be led to be- lieve, at first sight, that this projection is formed by the superior fragment, which, in quitting its natural situa- tion, is drawn up above the inferior ; but if we reflect a little, we shall see that the end of the superior fragment projects ; because the inferior fragment is displaced, and drawn to that side where the strongest muscles are attach- ed. Thus we observe, if we reduce the inferior fragment to its natural place, the projection formed by the supe-

rior fragment, disappears. If, instead of this, we make
use of tight bandages, or any machine to reduce the pro-
jecting end, we never succeed; and if we persist in the
employment of these means, inflammation will supervene,
and perhaps gangrene of the skin, and other soft parts
that cover the projecting point of the bone.

In relation to the circumstances which accompany
fractures : We distinguish them into simple, compound,
complete, incomplete, and complicated. The fracture is
simple when only one bone is broken, and the soft parts
have received only that degree of lesion inseparable from
the case, and without any accident that opposes the cura-
tive indication, which consists in the re-union of the di-
vided parts. A fracture is compound when the bone is
broken in different places, or when the two bones which
form a limb, as the forearm, are broken, without any other
accident. By incomplete fracture, some authors under-
stand that in which the two bones are broken at the same
time ; but according to the greater number, the fracture is
complete when the bone is entirely broken ; and incomplete
when the continuity is preserved in part, by means of some
bony portion which has not suffered division. Taken in
this last sense, the distinction of fractures into complete
and incomplete, is not admissible ; since, as we have al-
ready said, the solution of continuity always extends
throughout the thickness of the bone. A fracture is
complicated when it is accompanied by accidents which
multiply the indications, and require the employment of
different remedies, and different operations, in order to
effect the cure. Fractures may be complicated with con-
tusion, with wounds, with the opening of a large blood ves-
sel, with luxation and disease. The contusion and wound
are often accompanied with inflammatory swelling, with
fever, with acute pains, with convulsions, &c.

All fractures are accompanied with a certain degree of
contusion ; for an external force cannot overcome the co-
hesion of the parts of a bone, without acting at the same
time upon the soft parts over it ; and as these parts are
between the wounding cause and the bone, which is hard,
they must necessarily be bruised. Thus contusion can-
not be regarded as a complication of fractures, unless
it exist in a considerable degree, and requires particular
means, different from those we employ in simple fractures.
A solution of continuity of the soft parts, whether it be
occasioned by the fracturing cause, or produced by the
fragments of the broken bone, which tear the muscles and

skin, is always a complication of fractures, and is attended
with more or less inflammatory swelling, according to the
extent of the wound, and the nature of the torn parts.

Fractures are sometimes accompanied with luxation ;
but this complication is rare : it can only take place
when the luxation precedes the fracture, or when accidents
are produced at the same moment, and by the same cause.
After a fracture has happened, a luxation cannot take
place, in consequence of the small extent of surface
which the fragments offer to the action of external causes,
and their great mobility. The action, then, of these pow-
ers is limited to moving the fractured ends, burying them
in the soft parts, producing greater or less laceration.
Fractures are complicated with other diseases ; as scor-
butus, syphilis, &c. and this complication is unfavourable,
as it retards the formation of callus, and sometimes pre-
vents it entirely. And, finally, an acute disease may oc-
cur during a fracture, and render the cure more long and
difficult.

ARTICLE II.

Of the Causes of Fractures.

The causes of fractures are distinguished into predis-
posing and remote, and into efficient and proximate. The
first are relative to the situation of the bones, to the func-
tions they fulfil, to the age of the individual, and to the
diseases with which he may be affected. The superficial
bones are, in general, more exposed to fracture than the
deep seated ones, which are covered by thick soft parts,
which protect them from external violence. The use of
certain bones exposes them to fracture ; the radius, in con-
sequence of its connexion with the hand, is more exposed
than the ulna ; the clavicle is often broken, because it
performs the office of an arch which holds the shoulder
from the trunk, and supports the efforts of the superior
extremity.

Old age ought to be arranged amongst the predisposing
causes of fractures. As we grow old, our bones become
more fragile, because they are charged with a greater
quantity of phosphate of lime. In old people, the quan-
tity of this saline and inorganic part of the bones is very
great in proportion to its fibrous and organic parts, and for
this reason the bones of old persons break with great fa-

cility. In children, on the contrary, the bones being more
fibrous, and less charged with the calcareous phosphate. en-
joy a greater degree of flexibility, yield and bend upon
themselves, when the fracturing causes act upon it, and
tend to break it.

There are diseases which manifestly dispose to fractures;
there are certain virus that act upon the gelatinous parts
of the bony system, destroy it, and render the bones very
fragile. Thus we sometimes see women that are attacked
with old and ulcerated fractures, break some of their bones
from the slightest causes, in making a moderate move-
ment, or merely in turning in their beds. The venereal vi-
rus, the scorbutic and rickety, and many others which it
is difficult to duly appreciate, may render the bones very
fragile, as the most authentic observations of surgeons suf-
ficiently prove. Some authors place cold among the pre-
disposing causes of fractures; but if fractures are more
frequent in winter than in summer, it is because falls are
more common, and the bodies on which we fall are harder.
The efficient causes of fractures act in overcoming the
force of cohesion of the parts, and in lengthening the bone
beyond its extensibility: they are external and internal ;
the internal cause is muscular contraction, which often
produces fracture of the patella, olecranon, and os calcis ;
the external are more common : sometimes they act far
from the place where the solution of continuity is produced,
and sometimes their action is limited to the place where
this solution of continuity is affected. When the fractur-
ing powers are applied to the two ends of a bone, they cause
a curve, and tend to approximate them: thus in a fall upon
the shoulder, the clavicle being violently pressed on the
sternum, is bent forward and fractured. If we fall upon
our hands, the radius being pressed between the weight of
the body and the earth, is bent towards its middle, and
fractured in that point of its length. The natural curve
of the bones determines as well the manner in which the
fracturing cause acts as the place of the solution of conti-
nuity. In this case the contusion would be less than if the
cause of the fracture had acted upon the place in which
solution of continuity happens. The ends of fragments
pushed against the soft parts only produce a greater or less
degree of laceration : but when an external power frac-
tures a bone at the same place where it exercises its ac-
tion, it bends the bone to the opposite side, and bruises the
parts which it strikes. Thus, for example, a blow with a
stick applied upon the middle of the clavicle, which is there

only sustained by the soft parts, bends it downwards, and never fractures it without occasioning more or less contusion, and sometimes a contused wound. When the fracturing cause is applied with great force upon a bone equally supported on all its parts, it breaks it into many pieces ; and this kind of fracture, always very serious, and often accompanied with wounds and lacerations, is termed comminutive.

ARTICLE III.

Of the Signs of Fractures.

The signs of fractures are divided into rational and sensible. The first are pain and inability of moving the limb : but as these effects may be produced by luxation and contusion, as well as by fracture, they cannot serve alone to establish the diagnostic. The sensible signs are very sudden changes that happen in the conformation of the limb, in its length, in its form, in its direction ; any separation, or inequality sensible to the touch, when the bone is superficial ; and, lastly, the crepitation produced by the rubbing of the ends of the fragments against each other.— Whenever we observe a diminution in the length of an injured limb, before we pronounce this shortening to depend upon the riding of the fragments, we must see if the extremities of the bones have not abandoned their articular cavities, and inform ourselves if the person have not naturally, or in consequence of some old badly reduced fracture, one limb shorter than the other.—If we compare the length of the inferior extremities, we must give to the pelvis an horizontal position, and place upon the same line the anterior and superior spinous processes of the os ilium ; for if these two prominences be not upon a level, the extremity towards which the pelvis inclines, will appear longer than the opposite extremity. They who know the conformation of our limbs, who justly appreciate the relation of the protuberances of the ends of bones, will easily perceive the changes that a fracture will produce in them. Whenever, by means of a fall or blow, the limb is concave in a place where it ought to be convex or straight, and *vice versa,* this change of form and direction must be the result of a fracture with displacement. The internal side of the great toe, when the person is lying upon an horizontal plane,

ought to correspond to the inner edge of the patilla: if
this natural relation be changed, and the inner edge of the
great toe corresponds to the external side of the patilla,
there can be no doubt of a fracture of the two bones of the
leg.   By pressing the fingers on tha' part of the bone near-
est the integuments, we perceive the inequalities which re-
sult from the displacement of the fragments.   This di-
agnostic is particularly easy when the bones are covered
with only a slight thickness of soft parts.   But in making
these examinations, we must take care to touch very gently
those parts where we see the splinters or points of bones
sticking out ; for by pushing hard the sensible parts
against the points and edges of the bones, we convert a
salutary examination with a cruel punishment.

The crepitation, or the noise, which the broken ends of
a bone make in rubbing against each other, is one of the
principal signs of fracture. To make this necessary exami-
nation with as little pain as possible, it is proper, if the
limb be small, to fix the upper part with one hand, while
the other gently moves the lower part.   Where the size of
the limb does not permit us to embrace it in this manner,
the upper part is to be held by an assistant ; so that in
moving cautiously the lower end, we may cause a slight
crepitation, which is sometimes audible to the ear, but
which the surgeon commonly feels by the shock which the
broken fragments communicate to his hands. A skilful
practitioner distinguishes easily the crepitation from the
crackling made by emphysematous tumours, when they
are compressed, and from the noise which the articulations
make when there is a want of synovia on their surfaces.
Although it is easy, in general, to discover a fracture by
the above signs, there are cases in which it is almost im-
possible to determine the nature of the accident, until the
expiration of the first three or four days. This difficulty
in forming the diagnosis may depend upon several causes.
Sometimes the bone affected is situated so deeply, and sur-
rounded by muscular masses so thick, that we cannot feel
the solution of continuity, and the crepitation is not to be
perceived : in such cases, if the displacement be not con-
siderable, as in certain fractures of the neck of the fe-
mur, we may easily mistake the nature of the accident.
Fractures of the bones of the forearm and of the leg, when
only one of the bones is injured, being sometimes without
displacement, are then difficult to discover ; the sound
bone supporting that which is fractured, hinders the dis-
placement to a certain degree, and prevents any sensible

alteration in the conformation of the limb. And if we be called too late, and swelling and inflammation have already supervened about the fractured parts, we cannot often determine the nature of the accident. In this case, where is the practitioner who has not hesitated before he could determine whether there was fracture or not? and even though he should discover the fracture immediately, he ought to wait for the abatement of the inflammation, before he should proceed to an exact reduction. When in spite of our most attentive examinations, we cannot discover a fracture, whose existence we suspect we ought to apply to the limb an apparatus to prevent displacement, and employ means proper to abate the swelling and inflammation. At the expiration of a few days, we shall either have discovered our error, and then we can take off the bandages whose application have produced us harm, or we shall be convinced in the reality of the fracture, and can pay that attention to it which it requires.

ARTICLE IV.

Of the Prognosis of Fractures.

The prognosis of fractures varies according to the kind of bone fractured, the place and direction of the fracture, the particular circumstances which accompanies it, and, lastly, the age and health of the individual.

1st. In relation to the kind of bone fractured. Fractures of superficial bones, and of those little surrounded with muscles, are *cæteris paribus*, more serious than fractures of bones surrounded by numerous and powerful muscles : thus a fracture of the clavicle is not so dangerous as that of the humerus. Fractures of the superior extremities are always attended with less danger than those of the inferior: those of short bones, when they are produced by external violence, are in general more serious than those of long bones, because they are commonly accompanied with greater contusion and swelling of the soft parts, and followed by a considerable stiffness of the joints.

2dly. In relation to the point of fracture. Fractures are less dangerous when they take place in the middle of bones : in these cases, the fracturing cause oftentimes does not act upon the spot when the fracture happens, the soft parts are not much contused, and inflammation is less

to be dreaded. Fractures of the ends of bones may occasion a false anchylosis of the neighbouring joints : thus in a fracture of the femur above its condyles, the inflammation extends to the knee joint, which contracts a stiffness that is only dissipated by degrees, and sometimes never completely removed : the inflammation extends to the articular surfaces, and is attended with more serious symptoms, because the contusion has been greater ; and, lastly, the splints having no hold upon the shorter fragment, the displacement more readily follows ; for this reason that a fracture of the neck of the thigh bone is considered more serious than that of any other part of the bone.   If a bone be broken in many places, the fracture is more serious, and the treatment more difficult ; but it is still more serious when two parts of a limb are broken at the same time ; for instance, the thigh and leg. It is then almost impossible to reduce and unite the fracture of the thigh, without a diminution of its length.   When the two bones of a limb are fractured, the case is more serious than when only one is broken.

3dly. In relation to the direction of the fracture. Transverse fractures are less serious than oblique, especially if the fragments remain supported by each other, and there is not a total displacement. Oblique fractures are more serious according to the degree of their obliquity ; for then the fragments not being held in their places by each other, are more easily deranged from their mutual contact by the contraction of the muscles : hence we consider an oblique fracture of the body of femur os almost as difficult to reduce as one of the neck of the bone.

4thly. In relation to the particular circumstances which accompany it.   Simple fractures, whatever may be their situation and direction, are less dangerous than complicated fractures, and these are more or less serious according to the kind of complication. A slight contusion does not add much to the danger of the accident, but when the contusion is great, and the bone broken into numerous splinters, some of which are buried in the flesh, the inflammation rises to such a height, that in a few days gangrene seizes the limb, extends to the trunk, and causes the death of the patient.   Fractures complicated with wounds are most serious of all ; the danger and difficulty of cure are always proportioned to the splintering of the bone, and the laceration of the soft parts. The accidents that follow these fractures are hemorrhage, inflammatory swelling, pain, fever, delirium, convulsions, gangrene, abscess, &c. The degree

and number of symptoms render the case more or less serious. When in a complicated fracture, the bones are uncovered, you must expect a long and difficult treatment, because the naked bone must exfoliate. In general, fractures, complicated with contusion and wound, are more dangerous in the inferior than in the superior extremities; and as it is almost impossible to cure them without some deformity or shortening of the limb, we must warn the patient's friends of these circumstances, that they may not attribute to the fault of the surgeon that which unavoidably results from the nature of the case.

The complication of luxation renders fractures more serious, for then it is impossible to reduce the luxation before the consolidation of the fracture, and when that is accomplished, the luxation cannot be reduced. And though we should be able to reduce the luxation before the union of the fracture, as we can sometimes in the ginglymoid joints, the accident is very serious, as anchylosis is the almost inevitable result.

5thly. In relation to the age and health of the individual. Fractures heal easier in young than in old persons, whose vital powers are weakened, and whose fluids are in a state of impoverishment very unfavourable to the formation of callus. In extreme old age, the cure of fractures is yet more difficult, and sometimes impossible. Experience proves that fractures are more easily consolidated in persons of a good temperament, and who enjoy good health, than in those who have a taint of any general disease; as the scurvy, syphilis, &c. When these taints exist in a high degree, they so vitiate the actions of the solids, and the quality of the fluids, as to prevent entirely the formation of callus. Pregnancy, contrary to what authors have said, does not prevent the consolidation of fractures, and in no way adds to the aggravation of the accident. But as there are examples of fractures in pregnant women, in which cases the consolidation did not take place until after delivery, we ought, in similar circumstances, inform the friends, that the treatment may be long and difficult, so that if any accident happen, the fault may not be thrown upon the surgeon.

ARTICLE V.

Of the General Treatment of Fractures.

The general treatment of fractures includes three prin-
cipal indications: 1st. To reduce the pieces of bones to
their natural situation; 2dly. To maintain them in this
state; 3dly. To prevent accidents, and to remedy them, if
they come on. The first indication arises only in fractures
with displacement; for in those in which the fragments
have not changed their relation, we have no need to make
any attempts at reduction; all we have to do is to retain
them in their situation.

Section I. Of the Means of Reduction.

The means we make use of in the reduction of fractures,
are arranged under three principal heads, extension, coun-
ter-extension, and coaptation; but they vary according to
the kind of displacement, and we generalize too much in
supposing they are all necessary in every kind of frac-
ture. There are cases in which extension and counter-
extension are altogether useless, as in fractures of the pa-
tella and olecranon, and in which the only displacement is
a separation of the fragments. In order to reduce this
kind of fracture, we give to the limb a position in which
the muscles that are inserted into the superior fragment
are relaxed, and then bring the fragments towards each
other.

We mean, by extension, the action by which we draw
the lower fragment of the bone towards us, in order to
put the fragments in their natural situation; counter-
extension is an opposite action, which hinders the whole
limb, or body, from obeying the efforts of extension.

The hands of intelligent assistants are best calculated
for these operations; we very seldom derive any benefit
from the employment of pulleys and mechanical contri-
vances, when the action of the muscles cannot be over-
come by the hands of the assistants. These violent means
only occasion great pain, and bring on a spasmodic con-
traction of the muscles, whose resistance augments as
we increase our efforts. This spasmodic re-action of the
muscles is sometimes so considerable, that we should
sooner rupture them, than lengthen them sufficiently to
bring the ends of the bones into contact. If the re-action
of the muscles be the effect of the irritation, swelling and

pain, we had better wait until these symptoms subside, be-
fore we proceed to the reduction. Formerly we were ad-
vised to apply extension to the inferior fragment, and coun-
ter-extension to the superior; but besides its being diffi-
cult and sometimes impossible to lay hold of the two frag-
ments (as in a fracture of the cervix femoris, for exam-
ple) in making extension and counter-extension upon the
bone that is broken, we compress the greater part of the
muscles which surround it, and this compression pro-
duces spasmodic contraction, which renders the exten-
sion and counter-extension useless, and often hurtful. To
avoid this inconvenience, we must make extension upon
the limb that is articulated with the inferior fragment,
and counter-extension upon that which is articulated with
the superior fragment. In a fracture of the leg, for ex-
ample, the means of extension act upon the foot, and the
counter-extension is applied to the thigh; and in a frac-
ture of the thigh bone, the extension acts upon the leg,
and the counter-extension upon the pelvis.

It is difficult to determine justly what degree of exten-
sion should be employed. This varies according to the
kind of displacement—the number and the power of the
muscles which surround the fractures. In transverse frac-
tures, when the displacement is in the direction of the
thickness of the bone, moderate extension is sufficient, and
we make use of it with the view of diminishing the rubbing
of the surfaces of the fragments, which always have rough
asperities; but whatever be the direction of the fracture,
when the fragments have slid up by the side of each other,
in order to replace them, we must use counter-extension
proportioned to the degree of shortness in the limb, and to
the force of the muscles that produced it.

Extension should be made gradually: if we draw sud-
denly and with violence all at once, we shall cause a spas-
modic contraction of the muscles, and perhaps rupture
them, for their fibres will not have had time to yield to the
power that tends to lengthen them. Extension should be
made in the direction of the inferior fragment, and con-
tinued in that which is natural to the body of the bone.

In every fracture with displacement, when the necessa-
ry extensions are made, we must endeavour to place the
fragments in their natural situation. This is called coap-
tation. The operation is differently effected, according to
the kind of displacement.

Although the reduction of fractures be, in general, easy,
it sometimes happens that the first attempts at reduction

do not succeed : we must then look for the cause that hinders the reduction. Sometimes the want of success arises from the forced extension of the member, and the unequal action of the muscles. We remove this obstacle by placing the limb in a state of semi-flexion, in which position all the muscles that pass over the fractured part, are equally relaxed. At other times the difficulty depends upon the extension being too feeble in proportion to the number and strength of the muscles, and then it is necessary to increase it to a sufficient degree. But our failures in attempts at reduction generally depend upon a convulsive contraction in the muscles, and the existence of inflammation, great swelling, and pain. If, in these cases, we persist in our attempts to reduce the fracture, and make use of violent extension, we only augment the irritation and spasm, and often do very great injury. In such cases, before attempting the reduction, we must endeavour to abate the irritation and pain, by blood-letting, low diet, diluents, emollient applications and anodynes. We are to continue the use of these means until we produce the desired effect; and then we may attempt the reduction.

We judge if a reduction is well made, when all unevenness is removed, and the part has recovered its form, its length, and natural direction, and the eminences of the bones and other external parts of the limb, have acquired their natural relations to each other.

Section II.   *Of the Means of keeping Fractures reduced.*

When the bones are replaced in their natural situation, if they could be kept so by the power of the will, there would be nothing else to be done ; but it often happens, that during sleep, in coughing, sneezing, &c. that they are again deranged. For this reason we are obliged to contrive different means to maintain the limb immoveable during the time that nature employs in the consolidation of the fracture. This second indication is more difficult to fulfil than is generally thought ; and it is in this part of the treatment of fractures that the surgeon shows his experience and dexterity. The means we make use of to fulfil this indication, are position, repose, bandages, and other pieces of apparatus, such as splints, bandages, compresses, and constant extension.

Position is a very important point in the treatment of fractures : it relates to the body and to the fractured limb.

In fractures of the inferior extremities, the patient must remain in bed, until the entire formation of callus. This should only be three feet in breadth, otherwise it would be very inconvenient for the surgeon and for the assistants ; it should have no foot-board, and should consist entirely of matrasses without a feather bed. We ought to fasten to the wall a cord, which hanging within the reach of the patient's hands, enables him to raise and move himself as occasion may require. We should firmly attach to the foot of the bed, a plank, to which is nailed a block, covered with a soft cushion ; against this the patient may support his foot, by which he will derive a great relief from pain. It likewise serves to keep him from slipping towards the foot of the bed, and with the aid of the cord, helps to raise him when the calls of nature demand it. The suitable disposition of the bed is so important an object for success in the treatment of fractures, that the surgeon ought to attend to its construction himself. The construction of the bed, however, requires less attention in fractures of the superior extremities.

The most favourable position of a fractured limb, is that in which all the muscles which pass over the broken part, and are inserted into the lower fragment, or to a part with which this portion is articulated, are equally relaxed ; and in which the affected limb is equally supported in every part ; and, in fine, in which it is least exposed to displacement, by the action of the muscles, the weight of the limb, or of the body.

The natural position of our limbs is that in which they are placed during sleep, which is a state of semiflexion. This position, recommended by Hippocrates and Galen, has since been strongly advised by Pott, who appears to me to have exaggerated its advantages. In general, it is no doubt preferable to any other ; but there are some exceptions, of which we shall speak hereafter.

Every fractured limb must be supported equally in every part of its length ; otherwise the fractured ends will incline on each other, and the parts which support the greatest weight will become painful, inflamed, and sometimes gangrenous. A pillow of chaff is preferable to every other support, because it may be accommodated to all the irregularities of the limb, and is less heating than a pillow of feathers.

The most perfect rest must be maintained, for a movement of the fractured ends on each other may prevent, or delay, their union. The patient must be directed to keep

himself perfectly quiet; and we are to employ bandages, pillows, splints, &c. The bandages which should be employed for this purpose, are the roller, the eighteen-tail bandage, and that of Scultet, which is a bandage of strips.

The roller should be about three inches broad, and long enough to cover the whole limb. It is applied in the following manner:—Having wet it with a resolvent liquid, we are to begin by making three turns over the fractured place; it is then to descend spirally to the lower end of the limb, afterwards ascend to the fracture, pass three times around it, and then pass up to the connexion of the limb with the body, and back again to its inferior extremity. Each turn of the bandage should cover three-fourths of the preceding. The inequalities of the limb require to make frequent turns with the bandage, in order to make an equal pressure on every part, and to prevent it from falling into folds. The bandage must be applied so tight as to cause a slight tumefaction above and below it, without pain or redness. That part of the roller alone which is immediately over the fracture, has any effect in preventing its displacement; the parts above and below it are useful only in preventing the bad consequences of unequal pressure, and the irregular contraction of the muscles. It will, therefore, be readily perceived, that the effect of the roller is by no means very great.

The eighteen-tail bandage is made of three pieces of linen as wide as the fractured bone is long, and long enough to go once and a half round the limb. It should be so constructed, that the piece which touches the limb is the shortest, the next a little longer, and the third longer still; they are to be laid on each other, and sewed through the middle; each side is then to be split in two places, and at equal distances. Thus we make nine tails on each side. After having laid the bandage smoothly on the pillow which is to support the limb, and wet it with a resolvent liquid, we are to begin by applying the tails of the upper piece of linen to the lower part of the limb, and the rest successively. The only advantage which this bandage has over the roller is, that it can be applied without moving and raising the limb, which is always injurious.

Scultet's bandage is composed of separate bands, three inches broad, and long enough to go round the limb once and a half. These bands are to be placed upon the linen which is to cover the splints, so that the first, which ought to correspond to the upper part of the limb, is covered by the second in three-fourths of its width; and so of the

others. We are to begin by applying the lowest, and the rest successively. This bandage is not perhaps quite so effectual as the roller, or the eighteen-tail bandage, in steadying the fracture : but it may be applied with greater exactness and uniformity without the least motion of the limb, and a part of it may be changed without removing the other. These advantages have led practitioners to prefer this bandage to all others, especially in complicated fractures of the lower extremities.

Fanons are composed of two small sticks, of the size of the finger, covered with straw, which is kept on by a string wound around it. Those intended for the leg, must extend from above the knee to two or three inches below the foot ; those for the thigh are of unequal length : the external one must extend from the crest of the ilium below the foot ; the internal terminates in the groin. The *fanons* are to be rolled, one on each side, in the lateral parts of a piece of linen large enough to support the apparatus ; they are to be tightened by three or four ribbons passed underneath. It is, however, previously necessary to fill the hollows of the limb. The use of the *fanons* is to maintain the fracture in its place, by preventing voluntary and involuntary motion ; for which purposes they are more effectual than any other part of the apparatus. They are particularly useful when we are obliged to transport the patient. Their round form, however, has one inconvenience—they do not prevent displacement of the fracture, unless they correspond exactly to the axis of the limb. Now, as both they and our limbs are round, it follows that, when we tighten the bands, they slip, and cease to correspond with the axis of the limb : hence they are generally abandoned. The same remark may be applied to another part of the apparatus, which consisted of two pieces of linen folded into a narrow strip, and twisted : over these the *fanons* were applied.

Splints are thin flat pieces of wood, pasteboard, tin, or sole-leather, which are applied to steady a fractured bone. They should be pliable enough to accommodate themselves to the form of the limb, and sufficiently firm to prevent the bones from getting out of place.

In simple fractures of the arm, forearm (and even of the thigh and leg in children), we may employ indifferently splints of wood, pasteboard, or tin. The pasteboard splints have the advantage of becoming soft when they are wet, and thus accommodating themselves exactly to the shape of the limb, which they retain after becoming dry : but they

prevent us from using a resolvent liquid, which would keep them constantly wet.

The length of the splints should always be at least equal to that of the fractured bone; and, where the situation of the limb allows, they should extend along its whole length; for, in general, the longer the splints are, the better they keep the fracture in place; but we should take care to keep their ends, which should be rounded, from pressing against the soft parts. The number of splints varies from two to four: in general, they should cover the whole circumference of the limb. We should avoid placing them over the principal vessels of a limb in compound fractures; of course, no splint must be put opposite the wound. But, if we are obliged to apply a splint over this part, a thick compress should be placed above and below the wound, so as to prevent it from being pressed upon.

Splints are to be applied with a roller, and tightened with ribbons. When they are too hard to accommodate themselves to the form of the limb, we should fill the intervening space with lint, carded cotton, or wool.

In simple fractures of the leg and thigh, splints made of wood are preferable, except in children. They should be made so thick as not to bend, their ends and sides should be rounded, and the spaces between the splints and the limb should be filled with little bags of chaff. It is necessary to put one of these bags under the thigh and leg, and accommodate the shape of the pillow exactly to the lower surface of the limb. Splints prevent any lateral or longitudinal displacement of the bones; but, in order to keep the limb from rotating on its axis, they should always extend to the hand or foot, as the case may be.

In transverse fracture, the splints, by preventing lateral displacement, also keep the bones from slipping by each other; but they have not this effect in oblique fractures, especially where the limb is covered with thick muscles: hence it is almost impossible for them to prevent a shortening of the thigh. In some cases, this has led to the idea of making a constant extension of the limb by means of a bandage or machine, which draws, in contrary directions, the broken pieces of bone. Continued extension has been disapproved of by several authors, who consider it as a violent remedy, calculated to irritate the parts, and to excite the muscles to strong contraction, the effects of which are always injurious. No doubt it would have all these inconveniences, were it employed in the first days of the accident,

when the muscles are irritated, and spasmodically con-
tracted; but, if it be had recourse to when the irritation is
totally dissipated, and simply with the view of preventing
their retraction, it will be found highly useful; it not only
prevents a shortening of the limb, but a stability which it
gives the bones, singularly favours the formation of callus.

To derive from constant extension the utmost possible
advantage,

1st. *We should avoid compressing the muscles which pass
over the fracture, since their elongation is necessary to give
the limb the length it has lost by the slipping of the fragments
by each other.*

With this view, the extension must be applied upon the
limb which articulates with the inferior extremity of the
fractured bone, and the counter-extension upon that which
articulates with its upper extremity. If we applied these
powers to the fractured bone, we should compress the
muscles which pass over the fracture, and a spasmodic con-
traction would result, that would render continued exten-
sion useless, and even injurious.

2d. *Extension, and counter-extension, should be applied
to as large surfaces as possible.* The reason of this rule is
evident, because external agents, acting upon a large sur-
face with a given degree of pressure, compress each part
less. The bandages should, therefore, be very broad.

3d. *Extension, and counter-extension, must be made in a
line parallel with the axis of the fractured bone.* If the
direction of these forces formed an angle with the axis of
the bone, they would lose part of their power; and, to effect
the end proposed, the force applied would have to be so
great, that it would be extremely painful, and even insup-
portable.

4th. *The extension should be made slowly, gradually, and
in almost an imperceptible manner.* Muscles yield easily to
force, which acts slowly; but if they be suddenly and vio-
lently stretched, a spasmodic contraction is excited; and
they will be torn sooner than relax, if this extension be per-
sisted in.

5th. *The parts acted upon by extension and counter-
extension, should be protected by bandages, or by a proper
machine.* This double indication is fulfilled by covering the
parts on which the bandages act, with carded cotton, or
wool, and filling the spaces left by the depressions of the
limb, with the same substance, so as to give it a circular
form,

By attending to these rules, continued extension can always be supported, even by the most delicate patients; and we derive from it the precious advantage of restoring the limb to its natural length.

SECTION III. *Of the Means of preventing and treating the occasional Consequences of Fractures.*

In all fractures, except simple fractures of the upper extremities, the patient should take nothing but broth for the first days. One or more bleedings are generally proper, together with the use of a cooling drink. After some time, we may gradually let the patient resume his usual diet. If we keep him too low, the consolidation of the fracture may be retarded. As the digestive funetions are often impaired from the want of exercise, the use of bitters is proper. The bowels should be kept open by the use of injections, if necessary.

As to external remedies, we should avoid plasters and ointments, which irritate the skin, create an itching, and sometimes even erysipelas. The bandages are to be wet with a resolvent liquor, such as spirits of wine, a solution of the acetite of lead, &e. Salt and water is an excellent resolvent; but it is not proper in this case, because it dries on the linen, and makes it stiff.

When we use the roller, and every thing goes on well, we should let it remain on for twelve or fifteen days at a time; but if it be too tight, or become loose, we should reapply it. When we use the eighteen-tail bandage, or that of Scultet, we may remove it more frequently; and, in all cases, it is proper to watch the patient assiduously, lest the fracture become displaced. It frequently happens that fractures of the lower extremities, and especially of the leg, get out of place, on the third or fourth day, by the twitching of the muscles. In this case, we should renew the apparatus, after having reduced it again.

Although the callus is commonly firm about the thirtieth day, we should prevent motion until it is perfectly consolidated; and, after removing the apparatus, we should cover the limb with a roller, in order to prevent edema; or to dissipate it, if it have come on. Some degree of stiffness always remains, which sometimes continues for a year or eighteen months. It is to be treated by frictions, relaxing applications, and baths. It may be prevented, in a considerable degree, by gently moving the joints near the fracture,

after the consolidation is sufficiently advanced to render safe this very delicate operation, which ought always to be done by the surgeon himself.

Section IV. *Of the Treatment of Compound Fractures.*

If great contusion accompany a fracture, we should use the bandage of strips wet with a resolvent liquor, and apply it with a moderate degree of tightness. The patient must be bled according to circumstances, and the apparatus must certainly be removed on the next day. By neglect of this precaution many limbs have become gangrenous, because the bandage is rendered excessively tight by the swelling of the parts. The limb is commonly found tumefied, tense, hard, and painful. It should be covered, in its whole extent, with an emollient poultice, which is to be kept on by means of a bandage and the rest of the apparatus.

When the contusion is excessive, and without wound in the integuments, the epidermis is sometimes detached, so as to form small phlyctænæ filled with yellow serum, which a young practitioner might mistake for gangrene. They are to be opened, and dressed with a little linen covered with cerate. By this treatment the swelling, tension, and pain generally subside in eight or ten days. We are then to leave off the poultices, tighten the bandages which confine the splints, and proceed as in simple fracture.

In fractures without external wound, a large artery is rarely opened; but if this do take place, the blood is injected into the cellular tissue of the limb, and produces a false primitive aneurism. In such a case, we should not hesitate to cut down to the artery, and tie it above and below the wound. We should not mistake the opening of a large vein for that of an artery. Such was the case of a man who was brought into the hospital Charité, three or four days after having suffered a fracture, with severe contusion, by falling from his cart. The leg was enormously swelled, and the skin of a violet marble colour. It was believed that the anterior tibial artery was wounded; but, as the infiltration did not increase, he was merely bled, and poultices were applied to the limb. The tension soon diminished, and the swelling was resolved.

If the upper fragment of a bone penetrate through the soft parts, and if the fracture be transverse, and the external wound large, it may be easily reduced by a moderate degree of extension; but if the fracture be oblique, and the bone terminate, as generally happens, by a long sharp

point, which comes out through a narrow opening, we
must enlarge the wound in order to replace it ; however, if
this be very difficult, it is better to wait until the tension
and spasm are dissipated by suppuration, at which time the
reduction may be easily accomplished. If a bone remain
projecting through the soft parts, it becomes covered exter-
nally with granulations, upon which the cicatrix is formed ;
thus leaving an unsightly projection at the part, after the
cure. When the projecting portion of bone is very long, it
is better to saw it off than to use any violence in reducing
it. I effected, with some force, the reduction of a fracture
of the femur, in a young and vigorous patient, by enlarging
the wound, through which projected the upper end of the
femur, deprived of its periosteum to an extent of three
inches. He seemed to do well at first, and I congratulated
myself upon the success of my practice ; but, on the third
day, the limb became prodigiously inflamed, with great ten-
sion and swelling ; and the gangrene which followed, not-
withstanding my best endeavours to prevent it, quickly af-
fected the trunk, and killed my patient. When, without too
much violence, we reduce a compound fracture, the injury
of the soft parts is to be treated as a simple wound, and
every method is to be taken to prevent inflammatory symp-
toms. When the bones of a limb are broken into several
pieces, and to a considerable extent, and the soft parts are
lacerated and bruised to such a degree that gangrene must
inevitably result, amputation is the only means of saving
life : this operation should then be performed as soon as pos-
sible. Some authors indeed, disregarding the lessons of
experience, have advised the defering of the operation for
two or three days, until they could give a fair trial to the
means of preventing mortification. It must, however, be
confessed, that great theoretical acquirements, acute pene-
tration, and long experience, are necessary to prevent us
from unnecessarily depriving a patient of his limb ; and, on
the other hand, from letting him die, by a vain attempt to
preserve it. The embarrassment in which the surgeon is
placed would be less, if he were not called upon to decide
in an instant ; but such is the nature of the accident, that
every moment of delay is of the utmost injury, and an hour
lost may consign the patient to his grave.

   If we conclude it expedient to endeavour to preserve the
limb, we are to proceed to the reduction, as in simple frac-
ture, taking, however, still more care to prevent the un-
equal contraction of the muscles, and the action of every
cause which might excite in them a spasmodic action ; but

the swelling and tension of the soft parts render it almost always difficult to reduce the fractures of which we are treating. Extension, applied to the limb, would not fail to augment the inflammation and irritation, and to produce convulsive motions and gangrene of the parts. It is, therefore, necessary to reduce the inflammation, by bleeding, poultices, anodynes, and the antiphlogistic regimen, before we proceed to the reduction.

If the bone be broken into many pieces, and some of them be entirely, or almost, separated, they should be removed; for, when they do not unite, they act as foreign bodies, keep up a constant irritation, and prevent the wound from healing until they are discharged. They should be extracted with great circumspection, carefully avoiding to excite hemorrhage. Incisions are often necessary, in order to avoid tearing the soft parts. We must not, with a false humanity, content ourselves with making incisions too small for the easy extraction of the splinters. The conduct of Ambrose Paré, in this respect, is worthy of imitation. In a complicated fracture, which he suffered from a kick of a horse, he earnestly entreated a skilful surgeon who attended him, to forget that he was his friend, and not to spare him; but to enlarge the wound with a razor, in order to put the bone in its place, and to extract, with his fingers, the splinters which were entirely detached.

If hemorrhage accompany a compound fracture, we are, in the first place, to tie the vessel from which it proceeds; after we have done this, and enlarged the wound if necessary, removed the separated fragments, reduced the fracture as well as the case will allow, and placed the limb in a proper position, the parts are to be covered with compresses wet with a resolvent liquid; the bandage of strips is then to be adjusted, after being wet with the same fluid; compresses and splints are then to be placed on the sides and anterior part of the limb, and retained by bands drawn moderately tight. Inflammation, fever, severe pain, and sometimes convulsion and delirium, supervene. The inflammation rarely terminates by resolution; copious suppuration comes on; or, if the inflammation have been excesssive, gangrene may follow.

During the inflammatory stage, bleeding, anodynes, and the antiphlogistic regimen, are necessary. Emollient poultices must be applied to the wound. When suppuration is established, the patient must take light nourishing food, bitters, and tonics, particularly bark: the wound is to be dressed with dry lint. The period at which this change of

treatment should take place, must be left to the judgment
of the surgeon.

In the first days of the accident, it is sufficient to dress
the wound once in twenty-four hours ; but, after suppura-
tion has come on, the repetition of the dressings must be
regulated by the quantity of pus ; if that be very great,
the dressings should be renewed twice in twenty-four hours.
They should be applied with great care, avoiding the slight-
est movement of the bones. If pus stagnate in the bottom
of the wound, it must be absorbed by little dossils of lint.
If this be not sufficient to prevent it from stagnating, the
wound must be enlarged, or a counter-opening made in a
depending part.

When the bone or bones of a limb have not been broken
into splinters, and the laceration of the soft parts has not
been great, with proper treatment the wound suppurates
moderately ; the presence of pus does not prevent the for-
mation of callus ; and, if the patient be young and vigor-
ous, the fracture may unite almost as well as if it had been
simple.

When the bones have been crushed, and the soft parts
bruised and torn, the suppuration is very copious. In this
case, if the fever soon abate, the suppuration diminish, and,
at the same time, the bones become covered with granula-
tions, without exfoliation, or after this process, we may form
hopes of cure. The surgeon should then redouble his care
and attention to second the salutary efforts of nature, and,
above all, to keep the fragments in the best possible posi-
tion. It is sometimes absolutely impossible to prevent the
limb from shortening, and becoming crooked. It would be
highly injurious to employ violent and repeated efforts in
order to effect a reduction of the fracture ; patients have
often died in consequence of the improper attempts of
young surgeons to reduce these fractures with great exact-
ness. As deformity is a necessary consequence of these
fractures, the surgeon should advise the friends of the pa-
tient, and the patient himself, that it is impossible to give
him a well formed limb—that the joints may remain stiff
for a long time, and that a fistula may follow, which will
not soon heal.

But all fractures are far from terminating even so fa-
vourably. Sometimes the suppuration, instead of diminish-
ing, continues copious, and the pus becomes sanious ; the
wound does not diminish in size, its surface becomes bloated
and spongy, the denuded bones remain detached ; the patient
loses his appetite and strength, and at length sinks under

hectic fever and diarrhœa. When matters have taken this
turn in spite of our best endeavours, amputation is the only
resource. It is true that some patients, after many of these
symptoms have appeared, have escaped with their lives,
without an operation ; but these rare cases do not invalidate
the general rule. Amputation will be most likely to suc-
ceed, if it be performed before the patient's strength is
exhausted by copious suppuration, fever, and diarrhœa ; and
this operation is most urgently called for, if frequent he-
morrhages come on, and they cannot be stopped by any
other means.

In some cases, the inflammation is so intense, that gan-
grene inevitably results. If it be confined to a small sur-
face, and attack only the skin and cellular tissue, it does
not add much to the danger of the case ; but when it
affects the whole thickness of the limb, its progress is often
so rapid that the patient quickly dies. However, it is fre-
quently arrested, and then amputation of the limb is indis-
pensable ; but the operation should not be performed until
the gangrene is defined, and the line of demarcation be-
tween the dead and the living parts is formed. It was once
believed that the progress of gangrene might be arrested
by amputating, the moment it began to appear ; but expe-
rience has fully demonstrated the futility of this attempt ;
and many cases have happened, in which amputation has
been unsuccessful, from having been performed before the
proper period. There is only one case in which we should
amputate before the gangrene is defined, this is when mor-
tification is extending to a part beyond which we cannot
amputate; and here its success is very doubtful.

There are three different periods in which amputation
may be performed : 1st. Immediately after the accident,
and before the appearance of the symptoms, when the dis-
order is such that the loss of the limb is certain. 2d. When
the inflammation has terminated in sphacelus. 3d. When it
has produced an extremely abundant suppuration.

In the first case, the operation is performed to prevent
the fatal symptoms which would otherwise inevitably result.
The success of the operation, in this case, depends upon its
being performed immediately, and before the parts are in-
flamed. In the second case, amputation is performed, to
remove the putrefying mass, and to spare nature the pro-
cess of separation, to which probably she would not be
equal. Lastly, in the third case, we amputate, in order to
prevent the total exhaustion of strength, which would fol-
low long-continued copious suppuration ; and, in this case,

the operation should not be performed until we are con-
vinced it would be unsafe longer to delay it.

Fractures are sometimes complicated with luxation :
when this takes place, we ought always, if possible, to re-
duce the luxation before the fracture. When the joint is
ginglymoid, and the ligaments are torn, the luxation may be
reduced without difficulty ; but when the articulation is or-
bicular, and surrounded by many muscles, and the fracture
is near the joint, or below it, the reduction of the luxation
is impracticable. The necessary extension would be highly
injurious, and probably unsuccessful ; we should, therefore,
wait until the fracture has acquired sufficient solidity to
support efforts for reduction ; and in order to prevent, as
much as possible, the stiffness of the ligaments and soft
parts, we should gently move the limb from time to time,
as soon as it can be done with safety. Notwithstanding
these means, we can rarely reduce the luxation after the
fracture is consolidated. There are, it is true, examples of
the reduction of very ancient luxations ; but, in these cases,
there has been no simultaneous fracture ; and I am not
aware that any luxation has ever been reduced after the
fracture which accompanied it has united. When a fracture
is complicated with any disease, such as scurvy for ex-
ample, which may prevent a union of the bones, we should
administer appropriate remedies.

ARTICLE IV.

Of the Consolidation of Fractures.

Fractures are united by an unknown process of nature, in
which the health is admitted to be perfect. This process is
analogous to the cicatrization of the soft parts, and is called
the formation of callus: the term *callus* is applied to a kind
of knot, or hardness, which forms on the two contiguous ends
of a fractured bone. We proceed to speak, first, of the time
in which callus forms, and of the circumstances which may
hasten, retard, or prevent it ; we shall afterwards mention
the local conditions necessary or favourable to the consoli-
dation of fractures ; we shall next state the different opi-
nions of authors upon this process of nature, and offer the
theory which appears to us most probable ; lastly, we shall

point out what is to be done at the ordinary period of the consolidation of fractures, which will lead us to consider *ligamentous union,* and the resources of art in like cases.

SECTION I. *Of the Time in which Callus is formed, and of the Circumstances which may favour, retard, or prevent its Formation.*

It is impossible to assign an exact time in which a fracture will unite ; it varies from twenty to seventy days, according to the age and temperament of the patient, the thickness of the bone, the weight it has to support, the difference of the season of the year, and the state of the health of the patient.

1st. Fractures unite more quickly in children than in adults or aged persons ; and the younger the child is, the sooner the callus will be formed. De la Motte saw two children, whose humeri, fractured in delivery, were united in twelve days. It has been said that, in tender infancy, an excess of callus is formed, which creates deformity ; but experience does not confirm this assertion, which appears to be dictated by theory, rather than founded on observation.

2d. A fracture unites much sooner in a robust man of a sanguine temperament, than in one who is feeble and cachectic. Ruysch and Van Swieten mention several cases, in which a concealed cachectic disposition prevented the formation of callus, though the patients were strong, and, to all appearance, healthy.

3d. The largest bones require the longest time to become consolidated : thus the femur requires more time than the tibia, and this last more than the humerus, &c. As the callus remains for a long time weaker than the other parts of the bone, we should avoid straining it. Fractures of the tibia require fifty days at least to become firm enough to bear the whole weight of the body.

4th. Moderate warmth is most favourable to the union of a fracture : hence they become consolidated rather sooner in spring and autumn than in other seasons ; but the effect of temperature is by no means striking.

5th. Fractures unite soonest in the most healthy persons. Cancer, scurvy, and syphilis have a particular influence on the bones, and retard, and even sometimes prevent, the formation of callus. Pregnancy does not appear to have any such effect ; however, Fabricius Hildanus cites two facts, which tend to prove the contrary. At the period of the

cessation of the menses, the formation of callus proceeds slowly, and fractures are subject to the same anomalies as other diseases to which women are subject at this critical period of their life.

Section II. *Of local Circumstances necessary to the Consolidation of Fractures.*

The local circumstances necessary to the solid union of a fracture without deformity, are, 1st. That the two fragments should enjoy a common life. 2d. That their broken surfaces should correspond. 3d. That they should be kept perfectly immoveable.

If one of the pieces of bone receive too little blood to nourish it, and to keep up its vital action, the fracture cannot unite. Thus, in certain fractures of the neck of the femur, in which the head of this bone being altogether detached, and the ligamentous tissue, which is reflected over it, as well as the vessels that pass through it, entirely torn, the upper fragment receives no other vessels than those which reach it through the round ligament, which are not sufficient for the work of consolidation; especially if, from the great age of the patient, the caliber of the vessels be excessively diminished.

An exact correspondence of the fractured surfaces is not absolutely necessary for their union, but a want of it always renders the formation of callus long and difficult. Thus, after fractures of the femur, where the bones have slipped by each other, and touch only at their sides, which are covered with periosteum, the fracture will hardly have begun to unite at the end of two months; and when the bones are united, a great shortening of the limb will have taken place.

Rest is so essential a condition to the union of a broken bone, that, if moved every day, it would not unite; the two ends would heal separately, like the sides of a wound that have not been kept in exact apposition; but the fractured surfaces do not become smooth and shining, and no orbicular ligament is formed, as we shall have occasion to observe hereafter.

Section III. *Of the different Opinions as to the Formation of Callus.*

This has been a subject of everlasting dispute. The ancients attributed it to the formation of a gelatinous liquor, called *osseous juice,* which hardened, and cemented the two

fragments, like glue. Hence they advise, in order to pro-
mote the formation of callus, that the patient should take
farinaceous vegetables, and grains boiled in water, or the
glutinous parts of animals, and especially make use of *osteo-
celle*, of which Hildanus relates such wonders.

But, were it thus, the callus would be inorganic ; or we
should have to admit that an inorganic liquid may become
hard, and form an organic substance, which is absurd. It
is demonstrated by observation, that callus is organized like
the bones with which it becomes identified.

According to Duhamel, callus is formed by the perios-
teum. When a bone is fractured, says this naturalist, the
periosteum of the two fragments at first unite, they then
swell, and form a ridge around the place of fracture ; the
other part of the periosteum also tumefies, softens, and
forms a sort of jelly, which quickly changes to cartilage ;
this becomes vascular ; nuclei of bone form, multiply, and
unite ; and when all the periosteum adjacent to the frac-
tured bone is thus hardened and ossified, it forms a kind of
ring, which laps over the fragments, and keeps them united.
In vain was Duhamel told, that, in sawing a bone which had
been fractured, the fragments were found completely identi-
fied, and not in simple contact, like two pieces of wood
placed end to end, and confined by a band of iron. He
answered, that the periosteum might extend from the cir-
cumference towards the centre, and undergo the same
changes as the bones themselves. Moreover, he supposed
that, in some instances, the internal periosteum, or medul-
lary membrane, generated elongations between the two
fractured ends ; and, lastly, that, in young persons, the
cartilages were capable of extension, and contributed to the
perfect re-union of fractures.

The system of Duhamel was long combated by Haller
and Dethleef, who, after a course of well conducted expe-
riments, reverted to the opinion of the ancients, that callus
was formed by a gelatinous juice which exudes from the
ends of the bone, and especially from the marrow, and
collects around the fracture ; that this juice becomes or-
ganized, is converted into cartilage, and lastly into bone.
This system differs in no way from that of Duhamel, ex-
cept that it supposes that the cartilage is produced by a
fluid rather than by the periosteum. We think Duhamel
attributed too much to this membrane ; but Haller and
Dethleef were certainly wrong, if they believed that inor-
ganic lymph could thicken, and form an organized sub-

stance.* It seems to us more natural to believe that the
gelatinous lymph contains, from the beginning, the rudi-
ments of organization, which afterwards receive further de-
velopement, and become visible, as it is generally agreed
that the rudiments of all our organs are contained in the
transparent mucilage from which the embryo seems to be
formed.

Bordenave, whose experiments correspond exactly with
those of Duhamel, Dethleef, and Haller, thought that the
fractured bones re-united in the same manner as soft parts.
He grounded his doctrine principally upon two observations
that are generally credited. 1st. That the bones contain a
vascular tissue destined to circulate the nourishing fluid.
2d. That this tissue dilates during the re-union of fractures,
as is proved by the swelling which takes place where the
callus is formed, and without which it would not unite.

" The soft divided parts," says this author. " principally
unite by means of cellular tissue ; the fractured bones also
unite by means of vascular tissue. The cellular tissue
swells to form the cicatrix ; the dilated vascular tissue en-
larges the extremities of the fractures. The cicatrix of
the soft parts is firmer, and appears to be formed of a sub-
stance more compact than the adjacent teguments. The
callus is at first raised, but becomes flat, and more compact
than the rest of the bone. In simple fractures, the bones
re-unite by the contiguity of the parts : the vessels are re-
united by means of an osseous juice flowing from them. It
is, however, different, when there is loss of substance in a
bone ; the vascular tissue cannot then form the re-union, or
it is formed by an inorganic mass, and frequently a space is
left in the part."

Bordenave, however, agrees with Haller and Dethleef:
1st. That, in the commencement of the formation of callus,
it appears to be a glutinous juice, furnished by the broken
vessels. 2d. That this substance afterwards takes the form
of cartilage, and receives vessels which deposit the osseous
matter, and thus commence the generation of callus. 3d.
The osseous particles unite, and callus is converted into a
porous substance, which, in time, becomes compact, like
the substance of the bones.

We shall, no doubt, always be ignorant of the process of
nature in the re-union of bones, as well as that of soft

* See M. Bordenave's second Memoir on the Bones, collected and pub-
lished by M. Fougeroux.

parts; all the theories formed to explain this point are, at best, only probable conjectures. If, however, it were necessary to adopt any one exclusively, we should prefer that of Bordenave.

The mechanism of nature is undoubtedly similar in the union of soft and hard parts. The periosteum and the medullary membrane, though they contribute to the formation of callus, do not probably form granulations on the surface of the fragments: these granulations never arise on the bones, unless they are denuded, and suppuration take place; and suppuration itself prevents the formation of callus: moreover, these granulations have never been seen in the bodies of men or animals who have died after fractures.

Callus begins to form about the fifteenth or twentieth day, but the process proceeds most rapidly about the thirty-fifth. At this period, therefore, the surgeon should be particularly solicitous to see that the fracture is accurately adjusted. There are cases, however, in which deformity inevitably arises from irregular ossification.

SECTION IV. *Of the Conduct to be observed at the ordinary Period of the Consolidation of Fractures and of preternatural Joints.*

When the time necessary for the union of a fractured bone has expired, we should carefully ascertain if the callus have acquired the necessary solidity. For this purpose, two assistants should take hold of the limb, one on each side of the fracture, and try very gently to bend the bone; and the surgeon places his fingers on the place of fracture, in order to discover if any motion take place; if it do, the limb must be placed in a proper apparatus, to prevent a new fracture, or, at any rate, deformity; and, even after the bones have become tolerably firm, the patient should walk with crutches, if his thigh have been fractured.

If, on removing the apparatus, we find that the callus is not yet solid, we should examine, 1st. The situation of the fragments and the consistence of the callus; 2d. The causes which may have retarded the union.

These causes may be external or internal. The first are, negligence of the surgeon, in not keeping the fracture at rest at the time when nature proceeds most rapidly in the formation of callus, and the indocility of the patient, in moving the limb against the advice of the surgeon. The internal causes are certain general affections, such as scurvy, confirmed syphilis, cancerous diathesis, &c.

As to the fracture itself, it is sometimes united by callus which wants the proper solidity; and, in this case, the co-aptation may be exact, or the bones may have passed each other. Sometimes the bones heal separately without any appearance of callus, and a preternatural joint is formed. In this event, we find the fragments sometimes rounded, sometimes pointed, and united together by a cellular and ligamentous substance; but their surface is not covered with a smooth and cartilaginous lining, nor is any orbi-cular ligament formed. I have convinced myself of this fact, by dissecting several unconsolidated fractures, which I still preserve. Among my specimens are some in which the bones are not at all diseased, and others, in which they are preternaturally light, deprived of their spongy and re-ticular tissue, and reduced to a single thin lamina.

When the callus is formed, but not consolidated, at the proper period, we are to continue the use of splints, &c. with great care. If the leg be fractured, a roller, paste-board splints, and common wooden splints, will be sufficient. If, however, the thigh have been fractured, the apparatus which is used for fracture of its neck will be found most advantageous. The time during which this treatment should continue, must be varied according to circumstances. If the patient be old, he should take generous wine, and live well; if he be affected with any internal disease, this must be treated with proper remedies. Nothing is more injurious than to rub the fragments rudely against each other, with the view to produce the necessary inflammation of the vas-cular tissue, for it breaks the callus which is formed.

The advantages of the treatment we have recommended, are proved by the following cases.

CASE I. Madame Cormier fell down stairs, and broke the tibia below its middle. I reduced it, and applied the com-mon apparatus. On the thirtieth day, the patient made a sudden motion to seat herself: she immediately experienced acute pain at the place of the fracture. When I removed the dressings, I found a slight displacement, which I reme-died by a suitable extension, and continued the apparatus until the sixtieth day. At this time the coaptation was ex-act, but the callus was still so soft as to permit a slight motion at the place of fracture. After having exhorted the good lady to be patient, I applied a roller, with four splints of pasteboard, and, above these, splints of wood, and filled up the intervals with little bags of chaff. I continued this apparatus six weeks, at which time the fracture had become solid.

CASE II. M. G—— fell, and obliquely fractured the
right leg a little below the middle part. M. Salmade, his
surgeon, immediately reduced the fracture ; and, the next
day, M. Sabatier and myself were called in consultation.
We removed the dressings : the fracture appeared to be
well reduced. In fifty days, the callus appearing to be so-
lid, we removed the splints, and covered the limb with a
roller. Three or four days after, the patient being seated
on an easy chair, his servant suddenly withdrew a footstool
from beneath his foot : he immediately felt acute pain at the
place of fracture, and we found the bones moveable upon
each other. We re-applied the apparatus : in two months
the callus was firm. Some violet spots that appeared on his
legs, led us to prescribe antiscorbutic plants, although the
gums were firm : there was no other appearance of scurvy.
The timidity of the patient prevented him from putting his
foot to the ground, until six months after the accident.

CASE III. M. X——, aged thirty-five years, fell from
his horse, and suffered an oblique fracture of the right leg
below its middle part. In sixty days the callus still wanted
firmness, and the limb had shortened nearly two inches.
Being called to the patient at this time, and finding the
bones very moveable, I applied a machine for making ex-
tension, and continued it eight weeks, when I had the satis-
faction to see the callus perfectly firm, and the limb of its
natural length.

CASE IV. In 1790, a young man, nineteen or twenty
years of age, enjoying good health, but thrown into a state
of despair by having gambled away a large sum of money
entrusted to him by a shopkeeper with whom he lived, jump-
ed from the bridge of the Thuilleries into the river. He
fell upon a raft, and broke his right thigh obliquely in the
middle. The patient was brought to the hospital Charité,
and the fracture treated in the usual manner. At the end
of four months the fragments had slipped by each other,
and were still very moveable. The consulting surgeons of
the hospital, having been assembled upon a number of very
serious cases, proposed several means for the treatment of
this ; such as moving the ends of the bone roughly against
each other ; cutting down to them, and scraping them with
a scalpel ; and, lastly, sawing them off. None of those,
however, who advised these several means, counted much
upon their good effects, and agreed that a preternatural
joint would be formed, and the patient remain lame. Pity-
ing the situation of the young man, and urged by his uncle,
who was one of the monks of the house, I undertook his

treatment. The limb was kept in a state of constant exten-
sion by the ordinary bandage, which was carefully tight-
ened every day. In three months, that is to say, seven
months after the accident, the fracture was firmly united,
and the limb was almost as long as the other.

Case V. N. M. Ricard, aged 64 years, carman, of the
village of Boulogne, entered the hospital Charité on the
25th March, 1799, forty days after a fracture of the thigh,
which was badly reduced. The treatment, conducted by a
quack, consisted in the application of four very short and
small splints, and the use of a particular wash. The appa-
ratus was taken off every day, and the limb moved, in order
to see if the fracture were uniting. The man entered the
hospital with the following symptoms : The left thigh, frac-
tured a little below its middle, was nearly five inches shorter
than its fellow ; the upper fragment, tapered by the absorp-
tion of its internal part, projected on the external side of
the patella, which it almost touched ; the lower part, which
could be easily moved, also projected, though slightly, on
the inside of the thigh. The fracture was exceedingly
moveable. I applied a machine for constant extension, an
engraving of which will be found at the end of this volume.
On the first day, the limb recovered an inch of its length ;
and it was gradually extended for ten days, when it was
almost as long as the other. These new extensions excited
so severe pain, that I was obliged to content myself with
rendering the limb immoveable, and preventing ulterior
shortening. In sixty days I removed the apparatus, and
found the bone perfectly united. The pressure of the straps
which held the foot to the foot-piece of the machine, had
caused some slight excoriations, and a considerable swelling
of the ankle joint, which were soon cured. The limb re-
mained shortened only two inches and a quarter. When a
fracture is not consolidated at a proper period, the broken
ends of the bone are covered with a fibrous substance, like
thickened periosteum, and what is called a *preternatural
articulation* is formed ; but, I repeat, I have never found
any thing which deserved the name of a joint—no capsular
ligament, nor smooth and cartilaginous substances ; on the
contrary, in the preternatural articulation of the femur and
humerus which I have dissected, are constantly found a
ligamentous substance, extending from one fragment to the
other. It is possible, however, that, in other fractures,
those of the forearm for example, a disposition of parts
may be formed, having a greater resemblance to an articu-
lation. Mr. Silvester, physician of the Faculty of Medicine

of Paris, communicated to M. Bayle the following case, which is published in the Gazette of the Republic of Letters.* " Some years since, a man, in falling, broke his right arm a hand's breadth from the wrist, so that the two bones were completely separated. The man was afraid to have any thing done; he would not even suffer bandages to be applied; on the contrary, he began by moving it, and, in the end, attained the power of bending it, even in the place of fracture. Thus he enjoyed, for a long time, the power of bending the limb at the joint and at the place of fracture. On dissecting his arm after his death, on the side next the elbow the bones were rounded off, and received into corresponding cavities in the lower pieces; the periosteum, which had been torn in the fracture, had become thick, so as to answer the purpose of a ligament; the edges of the cavities were much less elevated before than behind, so that a considerable degree of flexion could take place without much extension. The specimen is preserved in the cabinet of M. Duverney. Hildanus reports a fact nearly similar, in the ninety-first observation of the third hundred."

When a preternatural articulation is formed in the arm, or forearm, the limb does not cease to be useful; but, if it be situated in the thigh or leg, the patient can only walk with crutches. Three methods have been proposed for the cure of such cases: 1st. To rub the bones against each other; 2d. To cut off their ends; and, 3d. To insert a seton, which last has been employed lately, with success, by Mr. Percy, and by Dr. Syng Physick, of Philadelphia.†

The first plan was known to the ancients, since we find it described by Celsus, who had probably learned it of his predecessors. He uses the following expression:‡ *Si quando vero ossa non conferbuerunt, quia sæpe soluta, sæpe mota sunt, in aperto ciinde curatio est; possunt enim coire. Si vetustus occupavit, membrum extendendum est, ut aliquid lædatur: ossa inter se manu dividenda, ut concurrendo exasperentur, et, si quid pingue est, eradatur, totumque id quasi recens fiat, magna tamen cura habita, ne nervi musculive lædantur.*

The end proposed by this proceeding, is to form a new wound in the bone, by rubbing the fragments against each other; but when callus has begun to form, this retards the process of nature, and prevents its consolidation. If, on

* July, 1685, page 718, et seq.   † See note A.
‡ Lib viii. cap. x.

the other hand, the preternatural articulation be already
formed, the means of which we are speaking will be insuf-
ficient, and will lead to serious accidents, by tearing the
adjacent soft parts.

Re-section consists in sawing off the two ends of the bones,
after having uncovered them by a longitudinal incision upon
the fracture, then placing these ends in their natural situa-
tion. The treatment afterwards must be as for a fracture
complicated with wound. This painful and uncertain ope-
ration was probably not unknown to the ancients; we cer-
tainly know that they performed other analogous opera-
tions, such as the re-section of superabundant callus and
rupture of a fracture, in order to re-establish the length of
the limb; they even went so far as to rasp the ends of the
bone in preternatural articulations. Avicenna declares, that
Hali Abbas witnessed the death of a philosopher in conse-
quence of this operation. Guy-de-Chauliac blames this
philosopher, and declares that he acted very foolishly in not
getting along as well as he could with his lameness. But
we do not find, among the ancients, any example of this
operation, and it is uncertain if they ever performed it.
The parts covering the fracture are to be cut longitudinally
on that side which is least covered with soft parts, avoiding,
as much as possible, nerves and large vessels; the extre-
mity of each part of the bone is then to be brought out and
sawed off, while the soft parts are protected by a piece of
sheet-lead or pasteboard; the limb is afterwards to be
treated as in a case of compound fracture. This operation
is only practicable in the arm and leg.

White is the first among the moderns who proposed this
operation. and the able surgeon of whom he speaks, has
perhaps alone practised it with success. Mr. White com-
municated this case to the Royal Society of London, on the
27th of March, 1760. " Robert Elliot, aged nine years, re-
ceived a fall in the summer of 1759, and fractured the
humerus near its middle. A bone-setter was immediately
sent for, who applied a bandage and splints, and treated the
patient as well as he could for two or three months; but
the bones did not unite, and the boy was sent to the infir-
mary of Manchester. On examination, we found the patient
had suffered an oblique simple fracture, and that the extre-
mities lapped over each other. The accident had happened
six months before, and the limb was not only useless, but
burthensome.

" Amputation was proposed, but I would not consent to
it, as the union of the bone had not been prevented by age

or disease, but by frequent motion of the limb during the
formation of callus ; or rather the rough extremities of the
bone had divided some part of a muscle which had insinu-
ated itself between them. I proposed to the surgeons to
cut down parallel to the length of the bones, to saw off the
ends, and treat the case as a simple fracture.

" Some of the surgeons objected, 1st. That there was
danger of wounding the humeral artery with the bistouri ;
2d. That there was danger of tearing the artery in bringing
out the two ends of the bone : 3d. That there was no prece-
dent for such an operation. It was easy to obviate the first
objection, by cutting on the side of the arm opposite the
brachial artery. I proposed, in preference, the interior and
inferior part of the deltoid muscle, because the fracture was
near this part. Thus we avoided the danger of wounding
the vessels, prevented the pus from burrowing in the wound,
and facilitated the application of the dressings. The second
objection did not appear insuperable, when we considered
that, in compound fractures, laceration of the principal ar-
teries rarely happens ; and as the operation would be done
with care, there could be very little danger of such an
accident. The third, and last objection, was one which
might be raised against every new discovery.

" My proposal was finally adopted, and the operation was
performed, in my presence, by a very skilful surgeon, on
the 3d of January, 1760. The patient did not lose a spoon-
ful of blood, although no tourniquet was employed. When
the operation was finished, the apparatus was applied, and
the limb placed in the fracture-box.

" The wound had nearly healed on the fifteenth day,
when an erysipelas appeared, which extended over the arm.
This yielded to fomentations and low diet. Six weeks after
the operation, callus began to form, and it soon became
hard. The limb was almost as long as the other, very little
smaller, and was gradually growing stronger, when the
case was communicated to the Society."*

Since the time of White, the operation has been rarely
practised, and almost always without success. I performed
it once, but it did not succeed. The following is the account
of the case. A man, aged thirty-six, had a fracture of the
right arm, which did not consolidate for want of care. It
was above the middle of the humerus ; the arm had long
been useless, and the man was willing to suffer any thing
but amputation. I cut down upon the fracture on the

* Abridgment of the Phil. Trans. part vii. p. 442.

outer side of the arm, above the part where the radial
nerve winds around the humerus, so as not to paralyze the
extensor muscles of the fingers and hand ; I then brought
out the lower fragment, by elevating the elbow, and carry-
ing it inwards ; it was then sawed off. The dissection of
the upper fragment was more difficult. It formed a very
long cone, with a sharp apex. After this was sawed off,
and the bones put in their place, an interval of nearly two
inches separated them. In order to bring them together, I
raised the elbow, and passed some turns with a roller under
the forearm in a state of slight flexion, and carried them
obliquely over the shoulder. For two days the patient did
well ; but, on the third day, in addition to the other febrile
symptoms, the patient was affected with a well marked ery-
sipelas, which covered the opposite arm, extended to the
shoulder, and then affected the diseased extremity. The
tension was extreme. Instead of pus, bloody sanies flowed
from the wound ; gangrene followed, and the patient died
on the sixth day from the operation.

The method of employing the seton, is to pass it through
the limb, between the ends of the fragments, to produce
inflammation and the re-union of the parts. This method
has been employed twice, with success ; in one case, by
Dr. Physick ; in the other, by M. Percy, before the opera-
tion of Dr. Physick was known in France. We shall relate
these two cases, from an interesting Thesis of M. Laroche,
defended at the School of Medicine of Paris, in March, 1806 ;
entitled, " *A Dissertation on the want of Union in certain
Fractures, especially in those of the Arm, and a new Means
of curing the false Articulations which result.*" The author
saw M. Percy, at Augsburg, pass a seton through the cica-
trices of a wound of the thigh, with comminution of the
femur, which had not united. This celebrated surgeon, to
whom military surgery owes so great obligations, proposed,
by this means, to procure the discharge of any splinters of
bone which might remain, and to excite the divided surfaces
to re-union. The event answered M. Percy's expectations,
and the patient walked with a crutch two months after the
operation.

Two years after this case, the following communication
from Dr. Philip S. Physick, inserted in the Medical Repo-
sitory, 2d Hexade, vol. i. p. 122, was known in France.

" *A Case of* FRACTURE *of the* Os HUMERI, *in which the broken Ends of the Bone not uniting in the usual Manner, a Cure was effected by Means of a Seton. Communicated to Dr. Edward Miller, by Philip S. Physick, M. D.*

" Isaac Patterson, a seaman, twenty-eight years of age, applied to me, in May, 1802, in consequence of a fracture of his left arm above the elbow joint, which had taken place several months before; but the ends of the bone not having united, rendered his arm nearly useless to him.

" The history he gave me was, that, on the 11th of April, 1801, after having been at sea seven months, his arm was fractured by a heavy sea breaking over the ship. Nothing was done for his relief until dext day, when the captain and mate bound it up, and applied splints over it. No swelling supervened, nor did he suffer any pain. Three weeks after this accident he arrived at Alexandria, when the state of the arm was examined by a physician, who told him, that the ends of the bone were not in a proper situation. After making an extension, the splints and bandages were again applied. He remained in Alexandria four months, when, finding his arm no stronger, he left off all dressings, and went on board the New-York frigate as steward. In this capacity he remained near the Federal City six months, and by being under the necessity of using his arm as much as possible, he found the connexion between the ends of the bones became looser and looser, till at length the arm bent as easily as if a new joint had been formed at the place of the fracture. From the frigate he went to Baltimore, where an attempt was made, by machinery, to extend the arm, and keep the ends of the bone in apposition, by continuing the extension. Under this treatment he remained two months, but experiencing no benefit, he was advised to come to Philadelphia. On examining the arm, I found that the humerus had been fractured about two inches and a half above the elbow joint, and that the ends of the bone had passed each other about an inch : the lower fragment, or that nearest the elbow, was situated over and on the outside of the upper portion of the bone. The connexion that existed between the ends of the humerus was so flexible as to allow of motion in every direction ; and, by forcible extension, the lower end might be pulled down considerably, but never so low as to be on a line with the end of the upper extremity.

" He was admitted into the Pennsylvania hospital the latter end of May ; but the weather becoming very hot, it

was judged best to defer any operation that might be neces-
sary until the fall of the year. Unfortunately he then con-
tracted a bilious fever, of which he was so ill that his life
was despaired of for some days. From this fever his reco-
very was so slow, that it was not thought proper to perform
any operation until December. It still remained to decide
by what means a bony union of the humerus might most
probably be effected. In the year 1785, when a student, I
had seen a case in our hospital, similar to this in every
essential circumstance, in which an incision was made down
to the extremities of the fractured bone, which were then
sawed off, thereby putting the parts into the condition of a
recent compound fracture. No benefit, however, was de-
rived from this painful operation ; and, some months after-
ward, the arm was amputated. This case had made a strong
impression on my mind, and rendered me unwilling to per-
form a similar operation. I therefore proposed to some of
the medical gentlemen of the hospital, who attended in con-
sultation, that a seton-needle, armed with a skein of silk,
should be passed through the arm, and between the frac-
tured extremities of the bone ; and that the seton should be
left in this situation, until, by exciting inflammation and
suppuration, granulations should rise on the ends of the
bone, which uniting, and afterwards ossifying, would form
the bony union that was wanting. This operation being
agreed to, it was performed on the 18th of December,
1802, twenty months after the accident happened. Before
passing the needle, I desired the assistants to make some
extension of the arm, in order that the seton might be in-
troduced as much as possible between the ends of the bone.
Some lint and a pledget were applied to the orifices made
by the seton-needle, and secured by a roller. The patient
suffered very little pain from the operation. After a few
days, the inflammation (which was not greater than what is
commonly excited by a similar operation through the flesh,
in any other part) was succeeded by a moderate suppura-
tion. The arm was now again extended, and splints applied.
The dressings were renewed daily for twelve weeks, during
which time no amendment was perceived ; but, soon after-
wards, the bending of the arm at the fracture was observed
to be not so easy as it had been, and the patient complained
of much more pain than usual, whenever an attempt was
made to bend it at that place. From this time the forma-
tion of the new bony union went on rapidly, and, on the 4th
of May, 1803, was so perfectly completed, that the patient
could move his arm, in all directions, as well as before the

accident happened. The seton was now removed, and the
small sores occasioned by it healed up entirely in a few
days. On the 28th May, 1803, he was discharged from the
hospital, perfectly well; and he has since repeatedly told
me, that his arm is as strong as it ever was.'

This interesting case may give a just idea of the merit of
the operation, and of the talents of the surgeon who per-
formed it. We would remark, however, that if the seton
acted only on a small extent of the surface of the bones, it
might fail.

Lastly, when all other means have been employed with-
out success, amputation is the only resource, and it may be
performed if the patient imperiously demand it.

After having finished the subject of fractures in general,
we proceed to speak of particular fractures; commencing
with those of the nose. We shall treat of fractures of the
cranium, in the article of Wounds of the Head.

CHAPTER II.

Of Fractures of the Nose.

WE include, under the head of Fractures of the Nose,
those which interest the adjacent processes of the
maxillary bone, as well as those which are confined to the
ossa nasi, because these fractures result from the same vio-
lence, and very often happen together.

Fractures of the nose are produced by a blow, or by a
fall, and are always attended with greater or less contusion
of the soft parts. A simple fracture may take place in any
direction: in this case there is no displacement: or the
fracture may be comminutive, and the fragments of the
bone driven in toward the nasal cavity. This last case is
generally accompanied by a wound. The fracture may in-
volve the lachrymal canal, and thus prevent the passage of
the tears into the nose, either directly after the accident,
or at a more remote period.

The percussion that causes fractures of the nose, is very
apt to extend to the head, and even to the brain: hence
they are often followed by symptoms of concussion, com-
pression, by collections of pus or blood in the brain, inflam-
mation of its meninges, and fractures of the cranium by

contre-coup. The fracture of the cribriform process of the ethmoid bone has been thought to depend upon the shock communicated to it by the perpendicular plate of this same bone : but, if we consider that this plate is extremely thin, and, of course, very susceptible of fracture.—that it does not articulate with the proper bones of the nose in young persons, and that the symptoms of which we have spoken have happened without fracture of the cribriform plate, we shall see how little credit this opinion is entitled to.

When fracture of the nose is simple, and unattended with displacement, it is difficult to ascertain its existence ; but this is of no importance, since we have only to treat the inflammation which attends it.

Fractures of the nose are by no means serious accidents, except by the deformity which they may occasion. They may, however, cause incurable fistula lachrymalis ; and, as injuries of the head, they may prove fatal. These circumstances should not be lost sight of. When the fracture is simple, it is to be treated merely as a contusion ; if, however, the fracture be compound or comminutive, and the fragments of bone be displaced, as generally happens, we are to raise them up into the nasal cavity into which they are driven. This may be done by introducing a cylinder into the nose, such as a director, for instance, and pressing it upwards and forwards, while a finger of the other hand is pressed upon the outside of the nose, until the fragments are adjusted in their natural situation ; of course, it would be impossible to make such reduction, if the fracture had existed for several days, and severe inflammation had come on. In this case we should reduce the inflammation, and then proceed to the reduction ; but we should not too long delay adjusting the bones in their place, for their displacement keeps up the inflammation, and, after a time, the reduction becomes difficult, from the union of the fragments ; and deformity is the consequence, as in the following case.

A little girl, eight years old, received a kick from a horse, which fractured and crowded in the bones of the nose. Severe inflammation ensued, which the surgeons wished to see entirely dissipated before they proceeded to the reduction ; it was, in fact, dissipated, but not until the reduction became impossible. A flattened nose, and an incurable fistula lachrymalis, was the consequence.

When the bones are once reduced, to use the expression of J. L. Petit, it requires a greater force to push them in than it did to raise them ; but if they are excessively broken, it will be proper to introduce a piece of a hollow gum-elastic

catheter into the nose, and press lint around it, so as to
support every part. Compresses, wet with a resolvent li-
quid, are to be lightly kept on the nose by means of a band,
or triangular handkerchief.

CHAPTER III.

Of Fractures of the Lower Jaw.

THE superficial situation of this bone, and the extent of
its surface, favour the action of causes capable of frac-
turing it ; but these causes are, in a great measure, coun-
terbalanced by its great mobility. Hence fractures of the
lower jaw are by no means common.

No fracture ever takes place at the symphysis ; when it
occurs between this part and the angle of the bone, the an-
terior part is very prone to displacement. Fracture is very
rare in that portion of the bone to which the masseter and
pterygoid muscles are attached, the neck of the condyle,
or even in the base of the coronoid process. Sometimes a
portion of the alveolar ridge is broken off.

The more oblique fractures of the lower jaw occur far-
thest from the chin, and the obliquity is from above down-
ward, and from before backward, which singularly favours
the displacement of the fragments.

The direction in which the displacement takes place de-
serves particular attention. When the bone is broken on
one side only, and in a portion of it anterior to the insertion
of the masseter muscle, the displacement is proportioned to
the distance of the fracture from the chin. In all these
cases, the fragments are drawn asunder by the elevator and
depressor muscles of the part. But when the fracture is
double and oblique, the chin, which forms the middle piece,
is drawn very much down, and somewhat backwards. When
the fracture is in the part where the masseter and ptery-
goid muscles are inserted, the bones are not at all displaced.
If the condyle be broken off, it will be drawn forwards by
the pterygoideus externus, while the jaw will retain its
natural situation.

The violence which causes fracture of the lower jaw, and
which is always external, may act upon the point where the
bone yields, or on a remote part. In the first case, the

force tends to straighten the bone, by pushing the chin inwards. Here the internal lamina of bone breaks first, and the fracture separates the outer laminæ successively. In the second, there is a tendency to increase the natural curve of the bone. This may take place from a fall or a blow upon the opposite side : and here the external laminæ are first fractured. The bone never yields when the violence is not very considerable : hence we generally find fractures, in this part, attended with severe contusion, and even an external wound.

This fracture is commonly discovered without any difficulty. A blow, a fall on the part, difficulty of pronunciation and mastication, and more or less pain, are presumptive signs of its existence. But if, in passing the finger along the lower edge of the jaw, we perceive an irregularity in the position of the bones, and if the teeth partake of a corresponding displacement, we cannot doubt the existence of a fracture. When the fracture is double, the deformity is very striking : but if there be no displacement, we can discover it by the means of crepitation only. In order to produce this, we should endeavour to move the fragments laterally upon each other. Fracture of the condyle may be readily known, provided no very considerable swelling have supervened.

Simple fracture of the lower jaw is not a serious accident, and it will get well without the aid of art. We have seen a porter that would not suffer any dressing, and who did not cease from speaking or chewing when the pain permitted it. The fracture was, nevertheless, consolidated, with a deformity, it is true, which might have been prevented.

According to some authors, the laceration or division of the inferior dental nerve would occasion severe pain, convulsive motions of the lips, swelling of the cheek, deafness, buzzing in the ears, inflammation in the eyes, and a copious secretion of saliva. Although I have seen a great many fractures of the jaw, simple and compound, and many that resulted from gun-shot wounds, I have never witnessed these phenomena ; once only I saw a double fracture of the jaw, with severe contusion, followed by a paralysis of the depressor anguli oris and the depressor labii inferioris, which I attributed to tearing of the inferior dental nerve. A slight contortion of the mouth was the consequence.

If the fracture be perpendicular to the length of the bone, it is sufficient to bring the jaws together ; but if the fracture be at once double and oblique, there is displacement in the direction of the thickness of the bone, and also in the

direction of its length. In this case, with the index-finger placed before the coronoid process, while the posterior frag-ment is to be kept back, the anterior piece taken hold of, with the index of the other hand on its inner side, and the thumb below, and thus drawn forward. Having thus reme-died the shortening of the bone, the displacement in the direction of its thickness may be removed, by placing the teeth together. As to the displacement of the upper portion, in fractures of the neck of the condyle, it can only be reme-died by displacing, in the same degree, the lower fragment : thus their natural relation is re-established. The jaws are now to be kept together : this may be done by passing a few circular turns of a bandage around the patient's nightcap, and fixing to it another band, which is to pass under the chin, previously protecting the parts by compresses wet with a resolvent liquid. Some authors prefer what is called a *chevetre bandage;* but it does not answer better than the simple bandage of which we have spoken, and its applica-tion is much more difficult.

These means are not sufficient in oblique and double frac-ture. In this case, in order to prevent deformity, difficulty of chewing and of pronouncing, it is necessary to place, be-tween the teeth of the portion that is not displaced and the upper jaw, a piece of linen, of a thickness proportioned to the extent of the displacement, and hollowed so as to admit the two ranges of teeth ; at the same time we should tighten that part of the apparatus which supports its base and presses it upward, and leave rather loose that part which passes over the external surface of the jaw.

Hippocrates and Celsus recommend tying the teeth toge-ther with threads of silk or golden wires. This treatment may be useful when a portion of the alveolar ridge is se-parated, and the teeth have sufficient solidity, and there is space enough to admit the application of the ligature.

In fractures of the neck of the condyle, before we apply the bandage, thick graduated compresses must be placed behind the angle of the jaw, in order to keep the inferior fragment forward. In every case, the patient must not speak or masticate until the fracture becomes firm. In simple fracture, if the apparatus be not too loose or too tight, or unless it require changing, from the quantity of saliva that runs upon it, it may remain on for ten or twelve days at a time ; but, in oblique fractures, a tendency to dis-placement generally renders it necessary to change it more frequently. In forty or fifty days the fracture is generally consolidated ; but if the patient have moved the fragments,

the formation of callus is prevented, and a preternatural
joint is formed, as I have seen in several instances. It is
remarkable that this occurrence does not much impede mas-
tication.

Compound fractures of the lower jaw require no particu-
lar rules for their treatment; we shall only remark, that
those which are caused by gun-shot wounds often unite
without much deformity, and in a short time, provided the
surgeon, when he dresses the wound, be careful to let his
assistant keep the bones in place.

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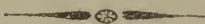
CHAPTER IV.

Of Fracture of the Vertebræ.

THE vertebræ are rarely fractured; 1st. By reason of
their small size, which, like that of all other small
bones, protects them, in a great measure, from the action
of external violence; 2d. Their mobility; 3d. Their deep
situation, in which they are protected by soft parts. How-
ever, there are some parts of the vertebræ which, by their
situation and structure, are exposed to fracture; such as
the spinous and transverse processes.

Violent percussion of the spine, whether it produce frac-
ture or not, may affect the spinal marrow, and even the
brain. These effects are most to be dreaded, when one or
more of the posterior laminæ are fractured, and the pieces
have pricked or compressed the spinal marrow. In these
instances, palsy of the lower extremities ensues, together
with that of the bladder and rectum; the contents of these
viscera are first retained, and afterwards discharged invo-
luntarily; the patient, constantly lying on his back, soon
feels pain in the sacrum; the skin inflames, and mortifies;
the separation of the eschar forms an ulcer, that extends,
and weakens the patient. On the other hand, the collec-
tion of fæcal matter and urine, and the introduction of air
by the bougie, irritate the rectum and bladder; the sides
of this last organ swell, the urine becomes thick and fetid,
a slow fever follows, and the patient dies in a few weeks.

Sometimes, when the affection is in the hypogastrium,
the paralysis extends upwards, and causes death, by imped-
ing respiration. When the palsy is confined to the inferior

extremities, it is not always fatal. In some rare cases, gangrene and hectic fever do not follow, and action is re-established in the limbs, and sometimes even in the bladder and rectum.

There is a great analogy between the phenomena we have described and injuries of the head : hence it has been supposed to be possible to perform the operation of the trepan, and raise the depressed portions, or evacuate any fluid that might be pressing on the spinal marrow. But the posterior lamina of the vertebræ is situated too deep for this operation ; there are, moreover, no symptoms that indicate the proper place for the trepan to be applied ; and, lastly, experience has shown that the same symptoms may arise from simple commotion, or stretching of the important parts, within the vertebral column. This is shown by a comparison of the four following cases.

A bag of flour, weighing three hundred weight, suddenly fell upon the nape of the neck of a porter when he least expected it. He experienced a sharp pain in the bottom of the neck. When he was brought to the hospital Charité, the spinous process of the seventh cervical vertebra was found more projecting than natural, all the limbs were paralyzed, respiration was laborious, and the rectum and bladder without action. The patient died on the seventh day. On opening the body, we found a fracture of the posterior lamina on the seventh cervical vertebra, with depression of a fragment which strongly compressed the spinal marrow.

A mason fell from a height of fourteen feet, and lost his recollection. When he came to himself, he found his legs paralyzed ; the urine and fæcal matter were first retained, and afterwards came away involuntarily ; fever supervened, respiration became laborious, and the patient died twelve days after the accident. On opening the body, we found an effusion of bloody serum, which filled the canal of the dura mater, from the inferior part to the middle of the back, and compressed the spinal marrow.

A stocking-weaver fell on his loins into a deep ditch, and immediately found his bladder, rectum, and lower extremities in a state of paralysis. The symptoms were the same as in the preceding cases, and the patient soon died. On opening the body, we found neither fracture nor injury of the spinal marrow or of the neighbouring parts, nor effusion.

A man, amusing himself with his friends, in twisting his body, felt a violent straining, and experienced a sharp pain in the whole length of the vertebral column. The next day,

his lower limbs, rectum, and bladder, were paralyzed. The symptoms went on as usual, and he died in a few weeks. On opening the body, every thing appeared natural.

The diagnosis of fractures of the vertebræ is always difficult, on account of the deep situation of these bones, and the little confidence that can be placed in the rational signs. If, however, the fracture be extensive, we may see some deviation from the natural situation of the parts, and even produce crepitation ; but this is a very dangerous practice.

Fractures of the vertebræ are almost always mortal ; however, musket-balls may fracture one of the processes without producing any serious symptoms, and the patient may soon get well. In these cases, it is sometimes necessary to make incisions to extract the ball, loose splinters, or other foreign bodies. In all cases, we should pay less attention to the reduction of the fracture than to the general symptoms. A slight pressure is sometimes proper, to keep the spinous process reduced. Bleeding, general and local resolvent fomentations, and camphorated liniments, to the abdomen, are proper ; the urine must be regularly drawn off by a catheter, and the rectum must be emptied by injections ; the excoriated parts must be protected by linen covered over with cerate ; if eschars form, styrax must be applied to them ; the ulcers which they form should be dressed with dry lint. If the patient be fortunate enough to recover the use of his limbs, he may perhaps derive a farther advantage from warm mineral springs.

CHAPTER V.

Of Fractures of the Sternum.

THESE fractures are rare ; the division is generally transverse or oblique, with or without displacement. Sometimes there are several fractures : when this is the ease. one of the fragments may be driven into the mediastinum, and impede the action of the heart or lungs.

Fractures of the sternum are always accompanied with contusion or wound of the integuments, and with a more or less serious affection of the organs in the chest. By reason of the elasticity of the cartilages. the sternum is easily pressed back, and the change of form produces a diminution of the capacity of the chest. Now this cavity. being always exactly filled, cannot undergo any considerable and rapid change of this kind, without subjecting the soft parts which it contains to compression, contusion, or even rupture. Very serious and fatal symptoms are sometimes occasioned in this manner. An effusion of blood, and of the medullary juice which exudes from the broken portions of the bone, may become infiltrated into the cellular tissue of the mediastinum, and give rise to inflammation, suppuration. or caries.

Fractures of the sternum are readily known by the inequalities of its surface, the movement of the fragments during respiration, and even by the crepitation which is sometimes caused by the motion of the chest. To these symptoms are often superadded depression of a part of the bone, pain, cough, and a difficulty of breathing. We must not, however, mistake a natural or acquired deformity for a recent fracture.

A simple fracture of the sternum, if properly treated. is a very trifling accident : if, however, the parts be driven in, it may prove fatal. If the fracture be not reduced, and the bones consolidate in this unnatural situation, a dry cough, oppression, and palpitation, may result.

The treatment of simple fractures of the sternum, without displacement, consists in preventing the motion of the chest in respiration, and the reduction of the inflammation. Thick compresses, moistened with a resolvent liquid, are to be applied to the sternum, and kept on by a bandage passed around the body, tight enough to oblige the patient to respire by the action of the diaphragm. alone. The patient must keep his bed ; his head and pelvis must be raised, and the thighs bent so as to relax the sterno-cleido-mastoideus

and recti abdomenis muscles, which might move the frag-
ments of the fracture. However trifling the inflammation
of the soft parts may be, we should have recourse to emol-
lient applications, venesection, and low diet.

When the fracture is comminutive, and the bones are
driven in, we should raise the fragments with a trepan, if
necessary. But the fracture of the sternum, or rather the
percussion of the chest, which has produced it, may give
rise to a very serious inflammatory state of the lungs, which
is attended with obtuse pain, and may be confounded with the
irritation, which always takes place during the first days of
the fracture. Oppression accompanies both cases ; but, in
fracture, the patient complains of a sense of weight, which
he refers to the sternum. In traumatic peripneumony this
symptom is not so striking ; the face is red, the conjunctiva
is injected with blood; the patient is stupid, and in a tran-
quil and transient delirium ; he coughs, and sometimes
raises blood ; the thirst is urgent; the pulse hard, quick,
and frequent. We must not lose a moment in combating
these symptoms the moment they appear : the disease too
often attacks the patient so suddenly, and with so little
pain, that it often proves fatal before we are aware of any
danger.

CHAPTER VI.

Of Fractures of the Ribs.

FRACTURES of the ribs are rare, although the breast
is exposed to violence and frequent percussions ; this
arises from their length, curved form, oblique situation, the
elasticity of the cartilages, and the mobility of their articu-
lations ; moreover, some of the superior ribs are protected
by the bones and muscles of the shoulder : for this reason,
these last are seldom broken. Fractures most frequently
happen in the middle ribs ; those below escape by reason
of their very great mobility. Fractures of the ribs are rare
in infancy, and more common in adults.

Fractures of the upper ribs are attended with danger, be-
cause they can only arise from very great violence : those
of the lower ribs are usually far less serious. The middle
of the rib is generally broken, and the fracture is commonly

oblique. The fracture may be caused by violence acting directly on the part, and driving it in ; or on the breast ; in which last case the broken ends project outwards. The former accident may be attended with serious injury of the lungs, or pleura ; in fact, the viscera of the chest always suffer more or less from the violence which causes the fracture. Sometimes the intercostal artery is wounded, and bleeds either externally or internally. We shall speak of this case, and of emphysema, under the head of Particular Wounds.

Fracture of one or more ribs is attended with fixed pain in some part of the chest, which renders respiration painful and laborious, and prevents the patient from taking a long breath. Crepitation also takes place from respiration, or it may be produced by pressing on the fractured part. In passing the finger along the rib, we perceive a part more sensible than the rest, but there is no displacement.

What we have said of the prognosis of fractures of the sternum, applies equally to those of the ribs. Simple fractures of the ribs require only the application of a compress to the fracture, and a bandage around the body, supported by a scapulary, so as to prevent all motion of the chest. When the fragments have a tendency to sink in, we should place on the broken rib, opposite its anterior and posterior parts, two thick compresses, so as to bend the rib outwards ; but when the fractured ends project outwards, a compress is to be placed on each side of the fracture, so as to keep them in. If passing a bandage around the body do not render the ribs sufficiently immoveable, we may use a cloth, doubled around the shoulders, and passed round the body.*

When the fracture is simple, we need only prescribe some cooling drinks and low diet for a few days. If there be symptoms of inflammation of the lungs, we must bleed very freely, and prevent the patient from moving or talking.

The cartilages of the fifth and eighth intermediate ribs have been found broken : the fragments were displaced generally in the same direction. They are easily reduced, especially during inspiration ; but it is difficult to keep them in place. They have never been known to unite in any other position than that given them at the time of the fracture. It is remarkable that a bony ring is always the medium of union. Very little inconvenience results from the impossibility of keeping these fractures reduced ; all that need be done is, to confine the parietes of the thorax.

* See note B.

CHAPTER VII.

Of Fractures of the Pelvis.

ARTICLE I.

Of Fractures of the Ossa Innominata.

THE situation of the ossa innominata, their form, and the thickness of the soft parts which surround them, renders their fractures very difficult, and very rare. They can be broken only by enormous violence, such as falls from a height, the kick of a horse, the weight of a loaded carriage passing over the hips, &c.

The two ossa innominata may be broken at the same time, but the fracture of one alone is more common. It is generally seated in the os ilium.

These fractures are necessarily accompanied with severe contusion. Some serious injury of the internal organs takes place at the same time ; the spinal marrow may receive a concussion ; blood may be effused into the pelvis, and the muscles, and other organs within the pelvis, may be severely bruised. From one, or all these circumstances, partial, or total loss of sense and motion in the lower limb, may ensue ; blood, or black bilious matter, may be vomited, or passed per anum, either immediately or after some time. To these symptoms are often added retention of urine, fever, painful tension of the abdomen, arising from inflammation of its viscera ; abscess, gangrene, and death.

The cause that produces a fracture of the ossa innominata, may, at the same time, effect a displacement of the fragments. When the fracture takes place at the pelvis or ischium, the fragments may be pushed into the canal of the urethra, or into the bladder, and occasion an infiltration of the urine, or only compress and interrupt the functions of these organs ; or they may be driven into the scrotum, the labia, or the muscles of the internal parts of the thigh. But when the fracturing cause has not effected a displacement of the fragments, it seldom otherwise happens.

The diagnosis of fractures of the ossa innominata is very difficult, on account of the depth of the parts, and their want of displacement. They may be presumed to exist, when the pelvis has suffered great violence, when there is

severe pain, and the motion of the trunk and lower extremities is difficult and painful. In a few instances crepitus may be perceived; but we must not confound it with emphysema, which frequently accompanies large infiltrations or collections of blood. These fractures are generally fatal, and always very dangerous.

The treatment consists in maintaining perfect rest, relaxing the muscles inserted into the pelvis, applying resolvent liquids and a bandage around the pelvis, supported by a scapulary, and two bands under the thighs. If the bones be displaced, they must be reduced by such means as circumstances require. When the urethra or bladder is injured, a catheter must be introduced to draw off the urine. It is sometimes necessary to cut down upon the splinters of bone, and remove them.

Great attention should be paid to the state of the viscera of the abdomen, in order to prevent inflammation.

One of the greatest difficulties in the treatment of these fractures, is the necessity of moving the patient for his natural wants. This may be done by means of pullies fastened to the ceiling, with a band under the thighs, so that the patient may raise himself.

When the fracture takes place at the pelvis, the swelling of the fragments, and their displacement, may ultimately occasion a difficulty of emptying the bladder, and require the habitual use of a bougie.

ARTICLE II.

Of Fractures of the Sacrum.

Although more superficially situated than the other bones of the pelvis, the sacrum is less subject to fracture than these last, from its thickness, the spongy nature of its tissue, and the advantageous manner in which it supports the weight and efforts of the trunk. It, therefore, requires excessive violence to fracture this bone. On the other hand, its fractures are generally more serious than those of the ossa innominata; for, besides the violent contusion and laceration that accompany its fracture, there is almost always a commotion of the sacral nerves, which may terminate fatally.

When the superior part of the sacrum is fractured (which seldom happens, from the thickness of the bone in that part),

there is no displacement, unless the bone have been crushed, and the fragments violently driven in. In this case, there will be considerable disorder in the external and internal soft parts. But, when the fracture takes place in the inferior part of the bone, which is much thinner, the fragments may be carried towards the rectum. It is difficult to ascertain the existence of these fractures, except they take place very near the os occygis.

The prognosis and treatment of fractures of the sacrum, are the same as of those of the ossa innominata and the vertebræ.

ARTICLE III.

Of Fractures of the Os Coccygis.

These fractures seldom take place, although the bone is thin and small, on account of the great mobility of its different parts.

In persons advanced in age, in whom some of the joints of this bone have become ancylosed, a fall upon the buttocks may produce this accident. The mobility of the fragments, and the acute pain felt on moving the lower extremities, by which the fragments of bone are acted upon by the glutæi muscles, sufficiently characterize it.

This fracture requires only rest, the use of resolvent applications, and general remedies, according to circumstances.

CHAPTER VIII.

Of Fractures of the Scapula.

THE deep situation of the scapula, surrounded on all sides by thick muscles, and its extreme mobility, render fractures of it very rare : they cannot be produced but by a direct and violent cause. Some of its parts, however, such as the acromion process and the inferior angle, not being so deeply situated, are more frequently broken. Fractures of the coracoid process, and even of the neck of the scapula, are cited ; but they must be exceedingly rare, and can be caused only by excessive violence.

When the body of the bone is broken, the fracture may extend either longitudinally or horizontally, or it may be comminutive. When there is a single vertical fracture, there is no displacement ; but, when the fracture is horizontal, the lower fragment is drawn forwards by that portion of the serratus magnus which is inserted into it, while the upper portion is raised and drawn back by the levator scapulæ and rhomboideus.

In fracture of the acromion, which frequently happens near its base, the external portion is drawn down by the weight of the arm and the action of the deltoid muscle.

When the fracture is situated above the inferior angle, so as to separate it from the rest of the bone, the inferior portion is drawn forwards and downwards by the serratus magnus, or forwards and upwards by the teres major and the latissimus dorsi, according as the fracture is situated more or less high up.

In fracture of the coracoid process, the pectoralis minor, the coraco-brachialis, and the short head of the biceps, which are inserted into this eminence, draw it downwards and forwards.

It is evident that, after fracture of the neck of the scapula, this portion must be drawn downwards, by the weight of the arm and the action of the long head of the biceps.

Most of these fractures are easily discovered ; the vertical fracture is the most obscure ; however, even here, crepitation is generally perceptible. The displacement of the acromion process is very evident, by the irregularity that is felt along the spine of the scapula—the situation of the arm, which hangs by the side of the body—the slight inclination of the shoulder—and, lastly, the facility with which the

fractured end may be replaced in its natural situation, by raising the arm toward the shoulder, and pressing the elbow against the trunk, so that the head of the humerus pushes up the acromion process and the triangular ligament which unites it to the coracoid beak.

Fracture of the coracoid process would be easily discovered, were it not attended with excessive swelling and contusion. The same may be said of fracture of the neck of the scapula.

Fracture of the body of the scapula is not a very serious accident; that of the acromion process, and of the inferior angle, are more difficult to keep in apposition. But fractures of the coracoid process are most difficult to manage: they often leave a permanent stiffness of the arm, with the loss of the power of raising the limb, atrophy, and sometimes even palsy. If the fracture be comminutive, an abscess sometimes forms between the bone and subscapularis muscle. If the pus do not make its way to the axilla, perforation of the scapula is necessary. When severe contusion of the external or internal soft parts accompanies these accidents, they become dangerous.

In all fractures of the scapula, the arm is to be fixed against the side. This is all that need be done in a simple vertical fracture; and, in most cases, it is all we can do. It is fortunate, however, that an inexact consolidation of the fragments does not injure the actions of the arm.

In simple vertical fracture we should place, between the arm and the trunk, folded compresses, to absorb the perspiration: a bandage is then to be passed around the body and the affected arm, with several turns under the elbow and over the shoulder.

Fracture of the acromion process is reduced, and kept in place, by fixing the arm by the side, and raising it parallel to its axis. In addition to the treatment required in the last case, it is necessary to pass some turns of the bandage under the affected elbow, in front of the arm on the same side— over the corresponding shoulder—obliquely behind the chest —under the axilla of the sound side—and over the affected shoulder—behind the arm—and again under the affected elbow, so as to describe a figure of 8. It is impossible, however, to unite this fracture without deformity; but, fortunately, this does not render the limb less useful.

Fracture of the coracoid process, and of the neck of the scapula, being always attended with violent contusion of the soft parts, requires much more attention to the treatment of the general symptoms, than to a nice reduction of the

bones themselves. It is often necessary to cut down to the place of fracture, and remove the detached fragments ; and to raise those that are depressed, by the operation of the trepan, if requisite

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CHAPTER IX.

Of Fractures of the Clavicle.

THESE are very frequent. They may result from vio- lence acting upon the two extremities of the bone, or at the place of fracture. In the first case, the most com- mon cause is a fall on the shoulder. The fracture is then in the middle of the bone, or a little without it ; the outer fragment is carried downwards and inwards, by the weight of the arm and the action of the muscles.

If a person fall upon his elbow, the external fragment may be pushed forward into the soft parts, and tear the bra- chial plexus, the subclavian artery, the cellular tissue, and even come out through the integuments ; but such cases are very rare.

When the clavicle is fractured by violence applied directly to the part, it is always attended with more or less contusion, if the fracture be situated between its sternal extremity and the insertion of the ligaments which unite it to the coracoid process. In this case there is always displacement of the fragments. When, however, the bone is broken between the coracoid and acromion processes, the pieces maintain their natural situations.

Nothing is easier than to discover a fracture of the cla- vicle ; the displacement is generally perceptible, the arm hangs by the side of the body, the forearm is extended, and the whole extremity is rotated inwards. The patient in- clines his head and body to the affected side ; he gene- rally supports the forearm of that side with the opposite hand ; he cannot raise his arm, or bring it forward ; and, above all, it is difficult for him to put his arm to his fore- head, or on the opposite shoulder ; if obliged to do it, he bends the forearm, and inclines the head and trunk to- wards the affected side. The shoulder is lower, and nearer the axis of the body, than the other. By moving the arm, we may cause crepitation ; and, lastly, by pressing the arm

upward and backward, we may give it its natural situation, and bring the fragments into contact.

But many of these symptoms are wanting in those fractures in which there is little displacement; however, by examining the part, we always perceive, near the acromion process, a slight depression, which disappears when we raise the shoulder.

Simple fracture of the clavicle is a very trifling accident. When left to itself, the fragments still touch and unite, but with deformity. If there be contusion, or injury of the important parts near this bone, the case is very dangerous.

No fracture is more easy to reduce, nor more difficult to keep reduced. The indications in the treatment are three: 1st. To keep the humerus raised; 2d. To keep its upper end outward; and, 3d. To keep the shoulder back. The most ancient treatment consisted in the use of a figure of 8 bandage, which was applied while the shoulders were drawn back. It is evident that this fulfils only the first indication; besides, it soon gets loose; and, if tightened, it causes insupportable pain, by its unequal pressure on the pectoralis major and latissimus dorsi. Petit endeavoured to obviate this inconvenience, by placing a compress on the back, from one shoulder to the other, and then applying the bandage, and tying the ends of the compress together; but this is no improvement.

The cross of Heister, the corset of Brasdor, and the strap of Bruninghausen, have all the disadvantages of which we have spoken, except that they are less painful.

Desault first hit upon the proper indications in fracture of the clavicle; yet he avows, with candour, that Paulus Egynita and Ambrose Paré entertained ideas analogous to his own.

The apparatus of Desault consists in a wedge-like cushion, made of soft linen, maintained in the axilla, with its base upwards, by means of a bandage passed around the thorax and over the sound shoulder; and two long bandages, which are applied as follows: The arm of the affected side, held horizontally during the application of the cushion, is brought down to the side; by this means the head of the humerus is brought out; and, on the other hand, the elbow being carried a little forward, the shoulder is at the same time carried backward. Thus two indications are fulfilled. By raising the elbow, the reduction is completely effected. All that remains to be done, is to fix the arm in this position. For this purpose, the first of the two bands is to be passed circularly around the arm and chest, from the elbow to the

shoulder ; the second, passing from below the axilla of the
sound side, rises obliquely over the affected shoulder, de-
scends behind the arm of the same side, under the superior
part of the forearm ; thence it passes obliquely under the
axilla of the sound side, behind the chest, and over the af-
fected shoulder ; it then re-descends before the arm, under
the elbow of the same side, and rises obliquely behind the
chest and under the sound shoulder, &c. continuing to pass
this circuit three times, and finishing by passing a few times
circularly around the body. It may be observed, however,
that the wedge-like compress of linen under the axilla, often
causes intolerable pain, and even deep ulceration, if it be
not removed. Cotton answers the purpose much better, but
it has not all the desirable firmness. The last band loses
much of its action in the prolonged spiral turns which it
takes from below the elbow of the affected side, under the
axilla of the sound side, to the opposite shoulder ; it is
much more useful when it is simply passed under the elbow
of the affected side to the opposite shoulder.

Such as it is, and even with some alterations, which we
shall presently describe, the apparatus is far from being
perfect : it is fatiguing to the patient, incommodes his respi-
ration, especially at first, and excites pain in the breast, par-
ticularly in females. But, what is worst of all, the bandages
soon become loose. To avoid this last inconvenience, and to
employ the method of Desault, with an apparatus more
simple and more easily tightened, without displacing the
fracture, we have invented another.*

A pad, constructed upon the principles we have laid down,
is supported, under the axilla of the affected side, by two
bands, that are tied over the opposite shoulder ; a girdle of
quilted linen, about five inches broad, is passed around the
body, at the height of the elbows, and tightened by three
buckles and straps fixed on its ends ; a bracelet of quilted
linen, four or five fingers wide, is placed on the inferior
part of the affected arm, and fastened by a band ; four straps
attached to the bracelet, two in front and two behind, are
placed in the buckles of the girdle, and draw the elbow
against the body, whilst the cushion in the axilla carries the
head of the humerus, and upper part of the shoulder, out-
ward ; by tightening the anterior straps, the elbow is brought
forward ; lastly, the weight of the arm is supported by a
sling, which passes under the hand and forearm, and is
fastened on the opposite shoulder.

* See plate I. fig. 1, 2, and 3.

This apparatus is very simple, and easily tightened. In some patients, however, those who are asthmatic, for example, neither this apparatus nor any other can be supported.

Where the fracture is complicated, we must first reduce the inflammatory symptoms ; and, in all these cases, we must be content with keeping the arm motionless near the trunk, and supporting its weight, as well as we can, by a good sling. We might here apply the apparatus recommended by Bell, had the necessity of fixing the arm immoveably by the side occurred to him.

After a simple fracture of the clavicle, the patient need not be confined ; however, he should not walk much, but preserve the sitting posture.

When fracture takes place between the coracoid and acromion processes, it is sufficient to raise the arm, and bend it to the chest. The apparatus, therefore, which we have just mentioned, and a large sling, are sufficient.

CHAPTER X.

Of Fractures of the Humerus.

WHEN the humerus is fractured below the insertion of the latissimus dorsi and teres major, it is called a *fracture of the body of the bone;* if above this part, the accident is termed a *fracture of the neck of the humerus.*

ARTICLE I.

Of Fracture of the Body of the Humerus.

The arm may be fractured in any part of its length ; but the fracture is generally in the middle, a little below, and sometimes a little above, the insertion of the deltoid muscle ; at other times, near the lower extremity of the bone ; the condyles have even been separated from each other. The fracture may be transverse, oblique, or comminutive, simple or compound. This fracture is always caused by violence acting directly upon the part.

PLATE I.

Represents a Bandage for Fracture of the Clavicle.

Fig. 1. A girdle of quilted linen, about five inches in breadth, and long
   enough to go around the body at the height of the elbows.
   A A. The external side of the girdle.
   b b b b. Buckles for the straps of the bracelet.
   c c c. Buckles to confine the girdle.
   d d d. Straps for the same purpose.
Fig. 2. A bracelet of quilted linen, not so broad as the girdle, and long
   enough to extend around the lower part of the arm.
   A. The bracelet seen from the outer side.
   b b b b. Straps that pass into the buckles of the girdle.
   c c c c. Holes to receive the lacing string.
   d d. The lacing string.
Fig. 3. The bandage applied.
   a a. The girdle.
   b b. The bracelet.
   c c. The straps of the bracelet received into the buckles of the girdle.
   d d. The lacing strings passed into the holes of the bracelet.
   e e. A wedge-like pad placed under the axilla.
   f f. Bands to confine it there.
   g g. A scapulary to support the girdle.

Plate 1.
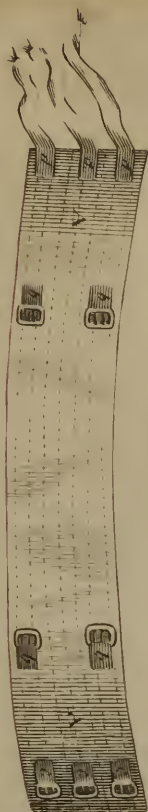
Fig. 1
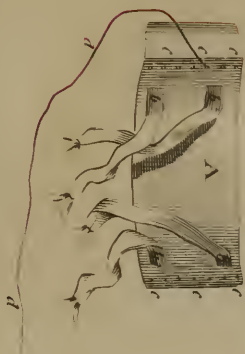
Fig. 2
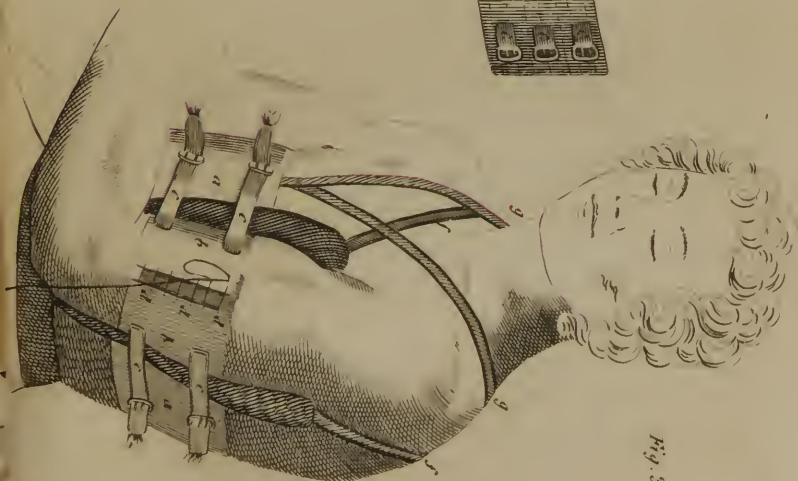
Fig. 3

When the fracture is below the insertion of the deltoid, this muscle drags the upper portion outwards, and a little forward, while the other fragment is carried in a contrary direction by the triceps.

When the arm is broken near the insertion of the brachialis internus, the displacement is trifling, because this muscle counterbalances the action of the triceps. When the fracture is situated near the elbow, the fragments can only be displaced backwards or forwards, since the brachialis internus and triceps are not inserted into this part of the bone, and the breadth of the humerus prevents the fragments from passing each other laterally.

When the fracture takes place above the insertion of the deltoid muscle, the inferior portion is carried outwards by the action of this muscle, while the upper part is drawn inwards by the pectoralis major, the latissimus dorsi, and the teres major. The weight of the arm, however, prevents the bones from overlapping each other.

Fracture of the body of the humerus is characterized by fixed pain, loss of motion, and deformity in the arm; the mobility of the fragments, and crepitation. In order to produce these last signs, the patient is to be seated, and the surgeon, placed at his side, is, with one hand, to move the elbow alternately inwards and outwards, while, with the other, he grasps the bone over the fracture.

When a fracture of the arm is situated very high up, it may be confounded with luxation of the humerus; when it is situated very low down, it may be mistaken for luxation of the forearm; or luxation may be taken for fracture, which last is attended with consequences far more serious. I could cite a great number of such cases, which I have cured; and many more, where, from the time since the accident had happened, it was impossible to prevent the total loss of the motions of the forearm. It must be confessed, that fracture of the lower extremity of the humerus is sometimes attended with so much inflammation and swelling, that the diagnosis is extremely difficult.

Simple fracture of the humerus is not a very serious accident, unless it be very near the elbow. In this case, it may cause severe inflammation, swelling of the ligaments, and a false ancylosis. Complicated fractures are more or less dangerous.

The treatment of fractures of the humerus is very simple; but as the apparatus necessarily compresses the lymphatics and veins, so as to impede their functions, swelling of the forearm and hand quickly takes place, unless we apply a

roller over the whole limb, beginning at the knuckles and proceeding as far as the elbow: the bandage is then held until the reduction is effected. For this purpose, an assistant, placed at the sound side, steadies the shoulder ; a second takes hold of the elbow and extends it ; and a third supports the hand ; while the surgeon, placed on the affected side, presses the fractured bones into their places. When the arm is restored to its natural length and direction, and the external tuberosity of the humerus is in a line with the most projecting part of the shoulder, the reduction is accomplished. The forearm is then bent, until it form an obtuse angle with the arm. With the remainder of the roller which was applied to the forearm, the arm is next to be covered, taking care to fill the hollow over the insertion of the deltoid muscle with lint or cotton—to apply the bandage moderately tight, in anticipation of swelling, and to place three or four circular turns around the fracture. Thin splints of wood or tin, rounded at the ends, and slightly hollowed, are now to be applied, one before and another behind ; if the limb be very small, we may employ three, which are to be placed at equal distances. An assistant is to support them, while the surgeon passes a roller from the shoulder to the elbow. The arm is to be brought near the trunk, and the forearm placed in a sling ; and some turns in the bandage, including the arm and the trunk, render the former perfectly immoveable. If the sling were placed behind the bandage, and above the turns which it makes, the wrist and forearm might be carried backwards and forwards, so as to rotate the inferior fragment in a very injurious manner. The apparatus, thus applied, causes no pain, unless the parts be contused and swollen ; in which case the bandage must not be employed until these symptoms have subsided.

The regimen is to be governed by the general principles we have laid down. We should, at first, renew the apparatus every seventh or eighth day, and afterwards less frequently, until the fortieth or fiftieth day, and then we should cover the limb with a roller, in order to prevent edema.

The treatment of fractures of the extremity of the humerus, even when simple, occasions much embarrassment to the surgeon ; being near the joint, they always cause inflammation and swelling of the ligaments that have been irritated by the cause that produced the fracture, and from which results a difficulty of motion, and what is termed a *false anchylosis.* The impossibility of avoiding this accident, renders it necessary to keep the forearm bent ; in which

position it is very difficult to keep the bones in place. It is not sufficient that they are surrounded by the apparatus; the lower portion is too small to be acted on, and it is difficult to fix the forearm in a given state of flexion, and to confine the fracture, without impeding the circulation.

It has been proposed to extend the forearm, and to surround the arm with four splints. This, it is true, would support the fracture in the most perfect manner, but it causes intolerable pain; and, moreover, if, in the end, the movements of the elbow be diminished or lost, nothing is more inconvenient than a stiff extended arm.

This inconvenience may be prevented, by rendering the apparatus as firm as possible, by covering the whole limb with a roller, and using two splints of thick wet pasteboard, one in front and the other behind: these are to be supported by a bandage, long enough to cover the whole limb twice. These splints are to be split on both sides, one fourth of their breadth, at the part corresponding to the elbow: by this means they are applied exactly to the limb; and when they are dry, they become perfectly solid, and form a kind of mould, which prevents motion of the forearm, and, consequently, of the inferior part of the fracture.

When fracture of the arm is complicated with contusion or wound, the limb is to be placed upon a pillow, the forearm being flexed at an obtuse angle; the bandage of strips is to be used; and, over it, are to be applied, first, pillows filled with chaff, and afterwards splints, supported by ribbons. The patient must be treated as in other cases of compound fracture. When the complication is cured, the apparatus before described must be applied.

ARTICLE II.

Of Fracture of the Neck of the Humerus.

The neck of the humerus is so small that it would seem impossible to break it; however, we have seen several examples of fracture of this part; but commonly the solution of continuity takes place near the insertion of the pectoralis major, the latissimus dorsi, and teres major.

As fracture of the neck of the humerus can only be produced by a cause which acts directly upon the upper and outer part of the arm, it is always attended with severe contusion.

When fracture in the neck of the humerus is situated be-
low the insertion of the supra-spinatus, infra-spinatus, and
teres minor, it unites without any difficulty; but when it is
situated above the tuberosities, exactly in the line which
separates them from the head of the bone, we cannot hope
for so easy and speedy a cure. Is there not as much diffi-
culty in consolidating a fracture of this kind, as one of the
femur, near its head? We cannot answer this question; for,
though we have seen several cases of this accident, all the
patients died in consequence of the contusion.

If we judge from some facts found in authors, and those
we have ourselves seen, it would appear that the superior
fragment of this fracture is susceptible of a certain destruc-
tion, caused by the rubbing of the extremity of the inferior
fragment; and that the superior fragment does not contri-
bute to the re-union. We have seen a woman, sixty years old,
who, by a fall upon the shoulder, suffered a fracture of the
neck of the humerus, with violent contusion. Delirium, and
tetanic symptoms, appeared on the third day, and she died on
the seventh after the accident. The fracture took place in
the hollow that separates the head of the humerus from the
tuberosities.; the superior fragment had suffered a consider-
able loss of substance on the side of the fracture; it was
evidently hollowed, and reduced to an *articular head*. In
a Dissertation by Reichel, two examples of this fracture are
found. In the plates that accompany the history of these
diseases, it will be seen that, in one of the two patients,
who was young, the re-union took place; but the natural
curve, in the neck of the humerus, had entirely disap-
peared; the head is lower than the tuberosities; the articu-
lar surface is turned inwards, and not obliquely upwards;
the bone has lost a part of its thickness; the callus is de-
formed, and its irregularities appear to depend exclusively
on the inferior fragment. In the second patient, who was
an adult, the general form of the superior extremities of
the bones was better preserved; the re-union took place by
a deformed callus, and stalactiform productions around the
fracture only, and appearing to belong to the inferior frag-
ment exclusively, as enveloping the superior one. In the
space left by these irregular bony columns, a probe could
be introduced, by which the hollow in the external part of
the head of the os humeri could be felt.

Fracture of the neck of the humerus is always accompa-
nied by displacement. The pectoralis major, the latissimus
dorsi, and the teres major, carry the upper portion of the
inferior fragment inwards, while the subscapularis and te-

res minor draw the superior fragment outwards. Thus displacement takes place in the direction of the thickness of the bone, but the fragments never cease to touch.

We might, at first sight, mistake fracture of the head of the humerus for a luxation; I have seen two examples of this error; nevertheless, the diagnosis is by no means difficult. In both cases, there is a depression at the external side of the arm below the shoulder; a hard tumour is felt in the axilla; the arm is turned outward, and the elbow separated from the trunk; communicated motions are painful; voluntary motion is lost.

But in fracture of the neck of the humerus, the depression on the external side of the arm is only perceived below the shoulder; while, in luxation, the shoulder itself is depressed; instead of being spherical, it is flat, and its upper end is terminated by the edge and top of the acromion process.

In fracture, the hard tumour in the armpit, which is formed by the end of the inferior fragment, is not remarkable: it does not extend high up, and its surface is irregular. In luxation, on the contrary, this hard tumour, which is formed by the head of the humerus, is situated very high up, and its surface is spherical.

In fracture, the elbow is separated from the body, but it may be brought near to it; the patient cannot move the limb, although it may be moved by the surgeon, with a little pain. In luxation, we cannot bring the arm near to the trunk; it is inclined outwards, and maintained in that situation. If we try to move it, we draw the shoulder at the same time.

In fracture, the superior part of the arm is very moveable; and, when we move it, crepitation is generally perceived. In luxation it is fixed, and there is no crepitation. Luxation of the arm requires considerable efforts to reduce it, while nothing is so easy as to effect the reduction of a fracture of the neck of the humerus.

It is easy to reduce this fracture, but very difficult to keep the bones in apposition. This may be readily conceived, if we reflect upon the smallness of the upper fragment.

Moscati, in a Memoir, which is inserted among those of the Royal Academy of Surgery of Paris, proposes an apparatus, which he considers superior to all others then in use. It is applied in the following manner: In the axilla is placed a large square compress of fine linen, split into four heads, two ends of which are carried around the shoulder,

and two around the arm, these last embracing the whole
limb, from the condyles of the humerus upward ; a second
piece of fine linen is applied to the armpit : pieces of picked
oakum are placed in the axilla and around the shoulder, so
as to form a stratum half an inch thick ; an oblong com-
press. of sufficient thickness. is to be applied to the external
part of the shoulder and arm, and should extend from the
lower part of the neck, between the clavicle and scapula, to
the inferior part of the humerus ; two other similar com-
presses are to be placed on the anterior and posterior parts
of the arm, and cross the first over the shoulder ; and a
fourth, the upper end of which should be folded so as to
protect the axilla, is to occupy the internal part of the arm.
All these parts of the apparatus are to be covered with the
whites of eggs, beaten up and expressed before their appli-
cation. Another square compress, split, and as large as the
first. should be applied, dry, over all. After this, a roller,
six or seven yards long, is employed in covering the arm
and body, finishing by some turns of the spica. The patient
should keep his bed, and the arm be supported by hard hair
or woollen pillows ; he must keep himself perfectly quiet
for some hours, until the white of the eggs has penetrated
the apparatus. This last is not to be changed before thirty
days. after which a lighter one may be applied.

The end which Moscati had in view, was " to put the part
in a kind of mould formed around it, so as to prevent it from
undergoing the slightest motion." It cannot be denied that
the apparatus may be exactly applied. and that it possesses
sufficient firmness to prevent the slightest motion of the
bones ; but, nevertheless, it has its inconveniences. The
hardness it acquires makes it incapable of extending, and
may render dangerous, the compression it exercises on the
parts. if considerable swelling come on. But its principal
disadvantage arises from the diminution of size, which the
soft parts undergo by the reduction of the tumefaction, by
which the mould becomes too large for the limb. More-
over, the hardness of the apparatus renders its removal in-
convenient, and liable to displace the fragments ; and this,
too. precisely at the time when nature is most busily at work
in consolidating the fracture.

In the kind of fracture of which we are treating, Ledran
covered the arm with a compress, one foot and a half long
and four inches wide, spread over with a paste made of Ar-
menian bole, the white of an egg, and vinegar ; and. pass-
ing the compress between the arm and the side, near the
axilla, he brought the two ends above the fracture, where

they were crossed so as to envelope the head of the bone.
He then placed under the arm, as high as possible, a com-
press, a finger's breadth thick : and, with a band of four
inches wide, he swathed the body and the arm. Some rising
turns of this band, on the forearm and hand, served to main-
tain them as in a sling, by carrying the rest of the bandage
directly upwards. All the turns of the bandage were sewed
together.

In considering this apparatus, we see that Ledran hit upon
the proper indications in the treatment of fracture of the
humerus ; which are, 1st. To prevent the pectoralis major,
the latissimus dorsi, and teres major, from carrying the in-
ferior fragment inward : 2d. To counterbalance the action
of the supra-spinatus, the infra-spinatus, and teres minor,
which tend to carry the extremity of the superior fragment
outward and backward ; and, 3d. So to fix the arm that it
cannot execute any one movement.

The method of Ledran is not a new one : it is found in
Paulus Eginita, who expressly recommended that, in frac-
ture of the humerus, the arm should be fastened to the
thorax. This method is now generally adopted, but with
some improvements, which we shall describe.

The patient being seated, an assistant steadies the shoul-
der, and another draws down the lower fragment. Thus
the fracture is reduced by the surgeon, who brings out the
superior portion of the lower fragment, and places it in ap-
position with the corresponding surface of the inferior frag-
ment. A roller is next passed over the whole limb, and four
splints are applied as high up as possible, taking care that
they do not injure the soft parts ; the arm is brought near
the trunk, and a wedge-like cushion, with its base upwards,
is placed between them ; several circular turns of the band-
age maintain the arm in this position ; lastly, a sling is put
on, and some turns of the bandage are passed under the
elbow and arm of the affected side, over the sound shoulder.

By a careful attention to the application of this bandage,
the tendency of the inferior fragment to pass inwards is
sufficiently counterbalanced ; and, if the superior fragment
be not very short, the splints prevent ulterior displacement.
The rest of the apparatus is intended simply to render the
arm immoveable ; but the bandages become loose, and, if
the superior portion be very short, it may be displaced ; in
fact, no external force acts upon this fragment, to counter-
balance the action of the supra-spinatus and infra-spinatus
muscles. However, if the reduction have been exact, the
lower fragment presses it up, and keeps it in place ; but, as

we have observed, the bandage becomes loose; and, if the fracture be situated near the tuberosities, we cannot prevent motion of the head of the humerus in the glenoid cavity.

From what has been said, it may be concluded that we have no apparatus by which a fracture of the neck of the humerus can be cured without deformity and some loss of motion in the arm; and it unfortunately happens that the fracture is not the most serious part of the accident which we have to treat.

As perfect immobility of the bones cannot be maintained, the apparatus must be continued for fifty or sixty days; for, when the fragments move upon each other during the treatment, the callus becomes firm very slowly.

In children, the causes of fracture in the neck of the humerus may produce a separation of the superior epiphysis. This accident, very rare, on account of the tender age at which it is possible, differs in no way from fracture in the neck of the humerus, very near the tuberosities, except that the difficulties in the treatment are greater than in fracture, because the solution of continuity is very high, and because the corresponding surfaces of the epiphysis and of the body of the bone, being less solid, do not so well support each other, and are less favourable to the application of the apparatus.

CHAPTER XI.

Of Fractures of the Bones of the Forearm.

THE superficial situation of these two bones, especially their small size, the nature of their articulation with the humerus, (which does not permit them to yield to external force but in two opposite directions), and their inclination to the axis of the humerus, with which they can never be brought in a straight line, are reasons why they are very frequently broken.

We shall treat, first, of what have been called *complete fractures*, that is, fractures of both bones at the same time: these we shall distinguish by *fractures of the forearm*. We shall afterwards treat separately of fractures of the radius, and those of the ulna. Lastly, we shall treat, in the fourth article, of fracture of the olecranon process of the ulna, because this fracture has nothing in common with those of which we have spoken.

ARTICLE I.

Of Fracture of the Forearm.

This generally occurs in the middle of the bones, sometimes more or less near their lower extremities, rarely high up. Sometimes the fractures of the two bones are opposite to each other; but this is not usually the case.

Fracture of the bones of the forearm results from the direct application of violence. A blow, or a fall on the part, are among its most frequent causes; but a fall on the hand, though it may break the radius, very rarely fractures the ulna at the same time.

Displacement of the fragments constantly accompanies fractures of the forearm; the action of the muscles, and especially of the pronators, draws the fragments together, so that they occupy the interosseous space; but, for reasons which we shall hereafter state, the upper fragment of the ulna can never incline outwards. Sometimes there is also a displacement in the direction of the length of the limb. This displacement depends upon the action of the extensor or flexor muscles of the hands and fingers; it may also be produced by the action of the cause which has occasioned

the fracture; but this last displacement is rare; the structure of the limb, and especially the interosseous ligament, prevent it.

This fracture is readily known, by change in the direction and form of the limb, which is bent forwards or backwards, and of which the cubital and radial edges are more or less depressed; there is motion and crepitation at the place of fracture; pronation and supination are difficult and painful.

The prognosis of this fracture is never serious; nevertheless, if, by bad management, the sides of the fragments are left in contact with, or approximated to, each other, and union take place under these circumstances, the movements of pronation and supination become very painful, or are entirely lost.

The reduction is very easy. The patient sits, with the forearm flexed, and in a state of semi-pronation; the surgeon places the fingers of each hand upon the palmar surface of the forearm, and his thumb upon the dorsal surface, opposite the interval which separates the two bones: thus he presses the muscles into this interval, and removes the fragments to their proper distance from each other.

The fracture being reduced, the surgeon takes two graduated compresses, each as long as the fractured bones, and having wet them with a resolvent liquid, he binds them on with a roller five or six yards long. At first he makes three turns around the place of fracture, and then descending to the wrist, and placing some turns on this part and on the hand, he covers the rest of the limb to the elbow. A splint of wood is to be laid upon each of the graduated compresses, and maintained there with the remainder of the roller; the hand is to be kept midway between pronation and supination; the forearm is to be bent at an obtuse angle, and supported by a sling.

We cannot omit to remark, that the exact application of the graduated compresses is the most important part of this operation: their thickness must be proportioned to the flatness of the arm, and should always be such that, when applied, the distance between their outer surfaces is greater than that of the external parts, over the edges of the radius and ulna.

In the application of the bandage, we should not forget that the limb will increase in size when inflammation takes place.

When the fracture is simple and the bandage well applied, it should not be removed oftener than once in ten days; the

patient need not keep his bed; during the day, his arm should be supported by a sling, in which it should remain during the night, unless the patient prefer placing it on a pillow.

In complicated fracture, the limb is to be placed on a pillow; Scultet's bandage should be used, with poultices, &c. according to the nature of the case. As we cannot foresee the period when we can apply the apparatus, and as, at this time, the bones may have united in an unnatural position, it is proper to advise the patient of the probable loss of, or difficulty in, the actions of pronation and supination.

ARTICLE II.

Of Fracture of the Radius.

Fracture of the radius is more frequent than that of the cubitus, or even that of the forearm: this arises from its situation on the outside of the arm, by which it is exposed to the direct application of violence; and its articulation with the three first bones of the carpus, by which it receives the whole weight of the body, in a fall on the hand.

In the first of these cases, the fracture may happen in any part where violence is applied, and contusion always accompanies the accident. In the second case, the fracture is generally situated near the middle of the bone, and the soft parts are very little injured.

The displacement of the fragments of the radius can only take place towards the ulna; and this effect is produced by the action not only of the pronator muscles, but also of those which are inserted into both the bones and the interosseous ligament. If the fragments unite in this state, the movements of pronation and supination become constrained, or are entirely lost.

We judge of the existence of fracture of the radius, by the circumstance of the patient having received a fall on his hand, or a blow on the external side of the forearm. If, at the same time, he complain of a fixed pain in some part of this bone, and we feel, on this point, a sensible depression and want of resistance; if pronation and supination be difficult and painful; and if, in resting a finger on the superior part of the radius, we find, during these movements, that it does not follow those of its lower extremity—there can be

no doubt of the nature of the accident. The existence of crepitus adds nothing to the certainty of these signs; for persons who are accustomed to hard labour, are subject to a singular affection of the cellular tissue, which surrounds the abductor longus and extensor brevis pollicis manus, in which these muscles cause a particular noise when they are compressed, not unlike starch when pressed between the fingers. This circumstance, however, can never mislead an experienced surgeon.

There may be some difficulty in ascertaining the existence of fracture of the radius, when it takes place near its inferior extremity. In this case, the interosseous space opposite the fracture being small, the displacement of the fragments is inconsiderable, and the depression that characterizes it is scarcely perceptible. There is generally a slight displacement of the superior fragment toward the dorsal or the palmar side of the forearm; and if swelling have taken place, this may have the appearance of luxation of the wrist. But if the projection formed by the superior extremity of the fragment be situated higher than the articulation, the movements of the hand and fingers are easy, as also those of flexion and extension, and the styloid process of the radius follows the movements of the wrist. All these circumstances will readily indicate a fracture of the extremity of this bone.

Fracture of the radius is of little consequence, when it takes place in the middle of the bone, and is occasioned by a fall on the hand, because the soft parts have suffered very little contusion. But when the fracture is situated near the extremity of the bone, it is more serious: there is always, in this case, a considerable swelling of the adjacent articulation, and afterwards more or less difficulty in its movements.

The treatment of this fracture is the same as that of fracture of the forearm. Great care should be taken to push the muscles between the two bones, so as to preserve the natural breadth of the interosseous space, and the free exercise of the motions of pronation and supination. As the fragments of the radius are united with the ulna, whose extremities support it, there is no danger of any shortening; the fragments only require to be replaced at a proper distance from the ulna. The extension should be made by inclining the hand upon the cubital edge of the forearm. The apparatus to maintain this fracture, is the same as that used for the fracture of the forearm, and must be applied in the same manner.

When the fracture has taken place towards one of the extremities of the radius, after the re-union of the fragments, attention must be paid to the adjacent articulations, which are always stiff. The chronic swelling of the ligaments, and other soft parts, are to be treated as we directed, in speaking of Fractures in general.

ARTICLE III.

Of Fracture of the Cubitus.

Fracture of the cubitus is much more rare than that of the radius. It may take place in any part of the bone; but it most frequently happens at the inferior part, which is the thinnest, and covered only with skin.

This fracture is always occasioned by a blow on the internal part of the forearm, or a fall on that part. The manner in which the cubitus articulates with the hand, and its direction in respect to the humerus, is such that it can never be fractured by a fall on the hand.

Fracture of the cubitus is very little susceptible of displacement, which can be produced only by the pronator quadratus muscle, that carries the inferior fragment outward towards the radius.

This fracture is easily known, by the projection formed by the extremity of the superior fragment, which may be felt, by placing the fingers on the internal side and posterior edge of the bone; by the depression immediately under this projection, the mobility of the fragments, and the crepitation. These two last signs are not always evident, as in fracture of the radius, because the cubitus does not participate in the movements of pronation and supination; but, by taking with one hand the inferior fragment, and gently moving it backwards and forwards, and with the other hand fixing the superior fragment, they are in most cases perceptible.

The treatment of fracture of the ulna is the same as that of the radius, except that, in the reduction, the extension must be made by inclining the hand towards the radial edge of the forearm, so as to bring the inferior fragment inwards, and separate it from the radius.

ARTICLE IV.

Of Fracture of the Olecranon.

This bone may be fractured in its middle, its base, or near its summit. It is almost always fractured in a transverse direction; sometimes, however, obliquely; at other times it is broken into splinters. The fracture may be simple, or complicated with contusion, with wound, and effusion of blood into the articulation, &c.

This fracture is almost always produced by an immediate cause; such as a fall on the elbow, or a blow on that part: in some rare cases, it results from the violent contraction of the triceps brachialis muscle.

Fracture of the olecranon is always accompanied by displacement. The superior fragment is drawn upward by the action of the extensor brachii, leaving an interval between it and the rest of the ulna, which may be increased by bending the forearm; but this interval is not generally great, because the aponeurosis which covers the olecranon resists the action of the muscles.

This fracture is known by the following signs : It is generally caused by a blow, or fall upon the part; there is more or less swelling; the forearm is half flexed, and the patient cannot extend it; near the elbow we remark a depression, into which a finger may be placed, and which is bounded below by the ulna, and above by the olecranon, separated from it and drawn up by the triceps extensor. This upper fragment is moveable in every direction, but especially from above downward; it may even be brought into contact with the lower portion; and if it be then moved laterally, crepitation is perceived.

These signs render it easy to distinguish this accident; but, if considerable tumefaction have come on, the diagnosis is exceedingly difficult. It may be then confounded with luxation of the forearm backwards; or, what would be a more serious error, this luxation may be mistaken for fracture. This may be avoided, if we consider that, in luxation, the forearm cannot be bent or extended beyond the degree in which it is thrown by the accident; while, in fracture, flexion and extension of the limb may be made by the surgeon with great facility.

In general, fracture of the olecranon is not a very serious accident. But, when this process is crushed, and the articulation is violently contused—when blood is effused into its cavity, and the soft parts are divided—very alarming symp-

toms, even tetanus, may ensue. I saw a case of this kind, which terminated fatally on the third day. The accident was occasioned by the explosion of a powder-mill.

Fracture of the olecranon is easily reduced; but it is very difficult, if not impossible, to keep the fragments in apposition; for, with whatever care we may apply the bandage, it quickly becomes loose; the triceps escapes its action, and draws up the olecranon; and this separation of the bones takes place, whether we keep the forearm extended, or flexed at an obtuse angle. The space which is thus always left between the fragments, becomes filled up by ligament. The separation is least when the forearm is kept fully extended; but this advantage does not compensate for the stiffness of the elbow-joint, which inevitably results from that uneasy position.

We have seen a great number of cases, in which this fracture has been left to nature, and in which the superior portion, separated from the inferior, has been connected to it by means of a fibrous cellular substance, which could easily be distinguished by the touch. This separation is never great, and does not increase; but it allows of a lateral motion of the olecranon, which, however, does not prevent the extension of the arm, or injure, in any way, the action of the triceps muscle; the limb is, in fact, not at all the worse. This ligamentous substance is produced by the thickening of the aponeurotic expansion, which quits the triceps muscle to cover the olecranon, and which is never broken.

Observation has proved, that the same result ensues when the fragments have been kept near each other by an apparatus. However, when this has been applied with great care, the distance between the fragments is much less. But this is not a very important advantage, as may be readily concluded from what we have already said.

The peculiarity of the mode in which the olecranon becomes united, was formerly attributed to the want of periosteum, and the constant presence of synovia. Camper first understood the real cause, and the mechanism of nature in the union of this fracture.

It is evident, from what has been said, that the indication is to keep the fragments as near together as possible, without, however, fatiguing the articulation, by complete extension of the forearm—and to favour the thickening of the aponeurotic expansion, and the formation of a solid ligamentous substance; avoiding, at the same time, to render the joint stiff and swollen.

If the fracture be not accompanied with swelling and in-

flammation, the forearm is to be slightly flexed, so as to form an obtuse angle with the arm. The hand and forearm are then to be covered with a roller, quite up to the elbow. An assistant is to hold the remainder of the roller, while the surgeon brings down the olecranon, by applying an oblong compress above it, and bringing its extremities forward crosswise. The roller is next to be passed over the compress and arm, after having made several turns in the form of a figure of 8, in order to prevent the olecranon from being drawn upwards. As soon as the bandage begins to get loose, it must be re-applied. It is to be left off altogether on the twenty-fifth or thirtieth day, when we are to begin very cautiously to move the arm. In forty-five days the union is complete, and as firm as it ever will be.

If there be swelling and pain, we cannot, with propriety, reduce the bone or apply the bandage. The elbow should be poulticed; and generally, when the inflammation has subsided, union has already taken place; so that, if we cannot use the apparatus before the twentieth day, it will do no good after that period.

We might relate many cases, to prove the correctness of the observations we have made: but we shall confine ourselves to the two following, which prove that the arm loses none of its power or dexterity when the fracture is left to nature.

A lady, aged fifty years, fell on the elbow, and broke the olecranon. Considerable tumefaction followed, and the surgeon did not discover the nature of the accident. Emollient poultices were applied for three or four weeks; and when I examined the limb after the swelling had subsided, I perceived the fracture, and the separation of the fragments by a ligamentous substance. Although the interval between the bones was almost one inch and three quarters in extent, after two months, during which the arm was moved, and wet with resolvent applications, the limb recovered all its force, and the joint all its mobility.

A mason fell from a high scaffold: he was brought to the hospital Charité; and as we discovered a wound of the head alone, we directed all our attention to this injury. At the expiration of fifty days, when the man began to go about, he perceived something unusual near the elbow-joint, which he showed to one of the students. I examined the part, and perceived a fracture of the olecranon, which had united through the medium of a ligamentous substance, a little more than an inch and a half in breadth. Notwithstanding this, the movements of the forearm were as strong and free as ever.

CHAPTER XII.

Of Fractures of the Bones of the Hand.

ARTICLE I.

Of Fracture of the Bones of the Wrist.

FRACTURE of the bones of the wrist can only arise from very great violence acting directly upon them; such as the fall of a heavy body, a cannon or musket-ball, &c. Hence it is always accompanied with severe symptoms, which require more attention than the fracture itself; and, in some cases, they lead to the necessity of amputation.

ARTICLE II.

Of Fracture of the Bones of the Metacarpus.

The bones of the metacarpus are seldom fractured; that which is opposite to the little finger is broken more frequently than the others. A fracture of this kind can result only from direct violence.

The fracture may be simple or compound; it may extend to one bone only, or to several; the latter is most common, and more or less contusion always accompanies these cases. I shall relate a case, which will show what is proper to be done, whether the fracture be simple or complicated.

An armourer being engaged in proving cannon, an iron ring, which he was using to retain the fire in the match, was driven against the palm of his hand by the explosion of a piece. It buried itself so far, that it projected at the back of the hand, under the integuments. It was drawn out, the wound was dressed with lint, and the hand covered with a poultice. On the fourth day, the patient complained of severe pain when he attempted to bend the ring-finger. I examined the part very carefully, but it was not until the tenth or eleventh day that, in pressing upon the lower end of the fourth metacarpal bone, I perceived a crepitation and mobility of the fragments, which showed that there was a fracture. When the inflammation and tumefaction had sub-

sided, and the small wound had healed, I placed along the
anterior and posterior parts of the fractured bone, two ob-
long compresses, extending to the end of the finger ; over
these I applied two little splints, and kept the whole in
place by a roller, which was passed first around the hand,
then around the three last fingers ; thus embracing the me-
dius and little-finger with the ring-finger, to which they
answered the purpose of lateral splints. The pain entirely
ceased after this apparatus was applied, and the cure was
completed in six weeks.

Comminutive fracture of several of the metacarpal bones
may be attended with so great injury of the soft parts, that
it becomes necessary to amputate at the wrist. But this
operation should never be resorted to, unless the injury be
inevitably irreparable, and the life of the patient would be
endangered by deferring it.

ARTICLE III.

Of Fracture of the Phalanges of the Fingers.

This is always accompanied with contusion. The dis-
placement takes place in the direction of the bones, the ten-
dons of the flexor muscles drawing towards them the infe-
rior fragment.

These fractures are easily known, and are not serious,
unless the bone be crushed. There is no difficulty in placing
the bones in exact apposition. The broken finger is then to
be covered with a little roller, wet with a resolvent liquid,
and splints are to be applied to the anterior and posterior
parts : these are to be bound on by further turns of the
roller. The adjoining fingers are then to be brought next
that which is broken, and the whole enclosed in a bandage.
Union takes place in twenty-five or thirty days.

In the most complicated cases, we are not to despair of
producing a re-union, but always bring the parts together
as well as we can. It is time enough to amputate, when
these endeavours fail.

If the last phalanx be crushed, it is, however, better to
amputate at once, than to endeavour to preserve the finger;
for, at best, the cure would be long and difficult, on account
of the inevitable exfoliation of the bone ; and the part would
be so deformed, as to be rather inconvenient than useful.

CHAPTER XIII.

Of Fractures of the Os Femoris.

THE great thickness of the soft parts around the femur, and the extreme mobility of its upper articulation, prevent, for the most part, the effects of external violence : on the other hand, its length and curvature, the angle formed with its neck, and the nature of its functions, cause it to be broken more frequently than the bones of the leg.

The fracture which takes place above the trochanters, merits particular attention, and will be treated of in a different chapter.

The femur may be broken in any part of its length ; but it is most commonly fractured at its middle. These fractures are generally oblique : in children, however, they are often transverse.

External violence is the only cause of fracture of the femur : that which acts on the two ends, usually breaks the middle. A very great force may fracture any part to which it is directly applied.

When the fracture takes place very high up, the upper extremity of the bone alone is displaced : in every other case, only the lower end is removed from its proper situation. If the fracture be near the middle of the bone, the flexor muscles of the leg, and the adductor muscles of the thigh, which resemble the cord of an arc formed by the femur, bend it back, and form a projection in front ; at the same time the lower end is drawn inwards, and the upper fragment projects on the outer side : the limb is then shortened by the overlapping of the bones. If the limb be placed horizontally, the foot, being without the central line of the thigh, draws with it the lower end of the femur, and rotates it outwards, so as to twist the fractured pieces.

In oblique fractures, the tension of the flexor and adductor muscles does not bend the pieces on each other, but causes an overlapping, to such a degree that the separated surfaces cease to touch each other : the lower fragment is drawn, by the adductors, above, and within the upper. The rotation outwards of the lower fragment, takes place as in the preceding case.

In children, in whom the fracture is almost always transverse, and in whom the muscles are not strong, the bones are bent upon each other ; but there is seldom any overlap-

ping of the ends. The fractured femur is often bent back-
wards, but not shortened.

When the fracture is directly above the condyles, the
lower portion is displaced by other causes, and in another
direction. The projection which they form behind the gas-
trocnemii, plantaris, and popliteus muscles, bend the upper
fragment forwards, and the lower portion is inclined back-
wards, towards the bend of the knee. The inclination of the
condyles upwards, causes a projection at the superior part of
the patella, and gives the knee a singular appearance.

When the thigh is broken immediately below the trochan-
ter minor, the psoas and iliac muscles, inserted into this
process, draw forward the upper fragment, and cause a pro-
jection in the groin.

When the trochanter major is separated from the femur,
it is drawn upwards and backwards by the glutæi muscles.

The general signs of fracture of the femur are, a fixed
pain, inability to move the limb, its shortening, its crooked-
ness, and a projection caused by the fractured ends ; their
mobility on each other, and the erepitus which this motion
produces.

Fracture of the femur is always a very serious accident.
The ancients considered a shortening of the limb as a ne-
cessary consequence even of a transverse fracture of this
bone ; and the case is far more difficult to manage, if the
fracture be oblique, or very high up. Fracture near the
condyles is more easily retained in its situation ; but here
there is danger of inflammation affecting the knee-joint,
and causing ancylosis, or a necessity of amputating the
thigh. Fracture of the femur, arising from violence ap-
plied directly to the broken part, is much more serious than
that which is caused by violence acting upon the extremities
of the bone, because it is always accompanied with severe
contusion of the soft parts.

When we are called to a case of fractured femur, we
should first arrange the bed. This must be a mattress
about three feet wide, without a pillow or bolster. A folded
sheet is to be placed under the breech, for the sake of clean-
liness, as well as to move the patient. A cord is to be
fastened to the ceiling, above the patient's breast, so that
he can aid in raising himself without moving the fracture.

The bed being thus prepared, the apparatus consists, 1st.
Of a piece of linen large enough to extend the whole length
of the limb, and to allow a splint on each side to be rolled
three or four times in it, and still be two or three inches
from the limb. 2d. As many bandages, three inches broad,

and of different lengths, each long enough to pass once and
a half around the part where it is applied, as will cover the
whole limb. These bandages are to be laid across a piece
of linen called a *splint-band*, so that they shall be covered by
two-thirds of each other. 3d. Two splints, long enough to
extend, one from the crest of the ilium, and the other from
the ischium, beyond the sole of the foot. These splints are
to be rolled in the sides of the splint-band, and in the ends
of the bandages, so that the splints are applied to each
other. A third splint is to be placed on the anterior part of
the thigh, from the groin to the knee ; or, what is better,
half way down the leg. 4th. Two double compresses, suffi-
ciently long to extend the whole length of the thigh, and
broad enough to embrace three-fourths of its circumference.
5th. Three bags filled with chaff, rather longer than the
several splints, and to be placed within them. 6th. Five
ribbons, an inch broad, and long enough to go round the
apparatus, and tie in a bow-knot. 7th. A resolvent liquid—
salt and water in preference.

The patient's clothes are to be cautiously removed ; the
pantaloons must be cut or ripped. It is better not to put the
apparatus on the bed before the patient is adjusted there.
In putting the patient on the mattress, the surgeon should
hold the limb above and below the fracture, while two as-
sistants are charged, one with the leg, the other with the
pelvis.

After the patient has rested a few minutes, an assistant is
to hold the lower part of the leg or foot ; a second, the
upper part of the thigh ; and a third, the part where it is
broken ; and all together are to raise the limb ; while the
surgeon, unrolling part of the bandage, places the apparatus
under the limb, taking care to see that it is high enough to
embrace the upper part of the thigh : he also places three
ribbons under the thigh and leg. The limb is then to be
laid upon the apparatus.

A strong assistant, placed on the fractured side, is charged
to steady the pelvis, by pressing strongly on the two anterior
and superior spinous processes of the ilium ; a second puts
his right hand around the heel, and the left over the meta-
tarsus ; and draws gently, first, in the line of the lower
fragment, and then in that of the limb. The surgeon, stand-
ing on the affected side, gently presses the broken ends to-
gether with the palms of the hands, and adjusts them in
their proper situation.

It sometimes happens that the muscles, instead of yield-
ing to the extension, contract strongly, and become hard

and swollen. If so, we must wait until the irritation and
spasmodic contraction subside, which happens on the third
or fourth day ; sometimes a little later. However, we must
confine the fragments, in order to prevent ulterior displace-
ment, which would keep up the irritation of the soft parts.

While the assistants maintain the fracture reduced, the
surgeon applies a resolvent liquid : he then places, before
the thigh, the double compress, which is to cover its whole
length, and of which the sides are to be brought out on each
side of the limb, and fastened below ; after which the strip
bandages are to be applied, beginning with those below.
The lateral splints are then to be rolled, one on each side of
the splint-band, until they are two inches from the limb.
The interval is to be filled with the bags of chaff, which
should be rendered thick opposite to the outside of the
knee, and in places where the space is greatest, and *vice
versa.* The third bag of chaff and splints are then applied,
and fastened, by the ribbons, on the fore part of the thigh,
beginning with the ribbon opposite to the fracture. A
cradle is then to be placed over the limb, to support the
bedclothes.

If the apparatus have been badly applied, and we have
occasion to remove it, we should begin by confining the pel-
vis, and extending the leg in the manner we have described.
A third assistant must steady the fracture, while the surgeon
carefully takes off the splints and bandages.

In ordinary cases, the apparatus should not be taken off
for five days. At this time the swelling is generally so di-
minished as to have loosened the bandages. It is proper,
however, to tighten the ribbons every day, as they become
relaxed. For four or five weeks, the apparatus is to be re-
moved every fifth or sixth day, in order to ascertain the
state of the fracture. After this period, it may remain on
eight or ten days. The apparatus is required to be conti-
nued forty days in children, and fifty days in adults. The
union of the bones is usually firm in fifty or sixty days ; but
before removing the splints, we should ascertain if the frac-
ture be sufficiently consolidated. This is done by placing
one of the hands under the fracture and pressing it up-
wards, and by directing the patient to raise the limb. If it
be firm, we should apply a roller over the limb, to prevent
edematous swelling.

After all, with every possible care, there is generally a
greater or less shortening of the limb. Sometimes the frac-
ture does not unite at the usual period, and we are obliged
to keep the patient in bed for five or six months ; and even

then the bones do not always unite, and a false joint is formed. Very often the patient begins to walk before the proper time; then the thigh bends backwards and inwards, and the fracture consolidates while the bone is in this situation. These inconveniences can only be avoided by applying the apparatus used for fractures of the neck of the femur, and which have been advantageously used in all fractures of that bone. But there are serious objections even to this treatment, and many patients cannot support it.

When the fracture is near the condyles, it is much more easily treated. It is proper to place a pad under the upper part of the thigh, to prevent the lower fragment from bending backwards.

In children, it is sufficient to apply a roller over the thigh, and splints of pasteboard, which need only extend to the foot. The apparatus should be covered with oiled silk, to prevent it from getting wet.

As to the general treatment, if the patient be young and plethoric, a bleeding may be proper; in other cases, low diet is sufficient. After some days, when the irritation has subsided, solid food and a bitter infusion are indicated.

In compound fracture of the femur, we are to follow the general rules laid down for such accidents.

Of Fracture of the Neck of the Femur.

Considering the deep situation of the neck of the femur, and its shortness, we should be led to believe it almost insusceptible of fracture. Nevertheless, there is no doubt that this accident is very frequent; and this is to be explained, by reflecting on its small size, its obliquity, and the thinness of the bony shell which covers its spongy substance.

The neck of the femur may be fractured above the attachment of the capsular ligament, or below it. In the former case, the fracture, which is within the joint, is generally near the head of the bone, and transverse; and the cartilaginous covering of its head is torn. In the second case, the fracture is wholly, or in part, without the joint; and its direction is almost always oblique, from above downwards, and from within outwards, so that the great trochanter remains on the upper fragment. Sometimes the neck of the femur is broken, both above and below the insertion of the capsular ligament. We have seen several examples of this double fracture. In other instances, the trochanter alone is detached. The neck of the femur is occasionally comminuted by a gun-shot wound; at other times, the ex-

tremities of the fracture are so rough and uneven as to diminish, or even entirely prevent, displacement; and several cases have been seen, where one of the fragments, shaped like a wedge, was received into a corresponding angle in the other. Fracture of the neck of the femur is rarely complicated with wound, unless in cases of gun-shot wounds; but there is generally more or less contusion, which leads to the necessity of using poultices, before we attempt to apply the splints.

The most common cause of fracture of the neck of the femur, is a fall upon the trochanter major; so that, as Professor Sabatier observes, when a patient has fallen upon the trochanter, this is of itself a strong presumption that the neck of the thigh-bone is broken. However, a fall upon the feet or knees may cause the same accident. The manner in which the fracture takes place, is different in the two cases. In the first, while the great trochanter supports the whole weight of the body, the head of the femur is pushed forcibly upwards and outwards by the acetabulum: here the tendency of the violence is to straighten the neck upon the body of the bone, and to destroy their inclination to each other. In the second, on the contrary, the feet or knees being stopped by the resistance of the ground, the upper part of the acetabulum presses the head of the bone downwards, and increases its obliquity to the axis of the femur. In the first case, the inner part of the bone, and, in the second, the outer part, yields first.

However astonishing it may appear, it is not the less certain, that the fractured pieces of bone are not immediately displaced. Some persons have walked home after fracturing the neck of the femur; in others, the bones have remained in their natural position several days, and have changed their place while the surgeon was moving the limb to ascertain the nature of the case. We have seen a man who walked with a stick several days after an accident of this kind. In all these instances, the bones are retained *in situ* by a strong fibrous covering spread over the neck of the femur, and by long projections of one piece received into corresponding cavities in the other.

After a short time, however, the fragments always become displaced, and slip by each other, so as to shorten the limb, sometimes several inches, at other times only a few lines. The greatest shortening takes place when the bone is broken below the insertion of the capsular ligament; for this ligament, which is never torn, prevents extensive displacement of a fracture within it.

The point of the foot and the knee are turned out by the weight of the limb, assisted by the action of the pyramidalis, the glutæi, the obturatores, and the quadratus femoris.

Some cases have been observed, in which the leg and foot have been turned inward. This circumstance was observed by Paré and J. L. Petit, and has puzzled many later authors. We have never met with it.

Before the bones are displaced, there are only three presumptive signs of the existence of the fracture of the neck of the femur:—the circumstance of the patient's having had a fall on the trochanter, his inability to move the limb, and his feeling a severe pain at the upper part of the thigh, and especially in the groin. But almost always some degree of shortening takes place. In order to discover it, we are to place the patient on his back, and to compare exactly every remarkable point on the two limbs, from the anterior superior spinous processes of the ossa ilii, to the malleoli interni ; for disease may have altered the length of one of the legs. When the shortening of the limb arises from displacement of the fragments of the fracture, the trochanter major is approximated to the crest of the ilium, and drawn a little backwards. Extension of the leg, made by drawing down the foot, restores the limb to its natural length. As soon as this ceases, it becomes shortened.

The foot and knee being turned out, the patient, in lying on his back, inclines to the affected side ; the limb is slightly flexed, and the heel lies in the hollow between the malleolus internus and the tendo Achillis of the sound side. But it is sometimes lower down, rarely higher.

By taking hold of the foot and knee, we may easily rotate the limb inwards ; but it does violence to the posterior part of the capsular ligament, unless we raise the trochanter major at the same time, and bring it forward, so as to relax the capsular ligament.

While the limb is rotated, we should examine if the trochanter major revolve in an arc formed by the radius of the semidiameter of the bone, or that of the length of its neck. It must, however, be confessed, that this sign is far from being so valuable as has been imagined.

As to crepitation produced by rotating the thigh, we have never been able to distinguish it. Moreover, we believe that attempts to make it perceptible are not unattended with danger, by the irritation they excite.

No author has mentioned a phenomenon which constantly occurs in the fracture of which we are treating. The pa-

tient, lying on his back, cannot raise the limb entirely, and
the efforts which he makes to do so are always painful, and
produce only a slight and slow flexion of the leg and thigh;
and draw the heel along the bed towards the buttocks, with-
out elevating it in the least degree. It is true, all this may
occur after a severe contusion of the joint; but if the same
phenomena be witnessed when the swelling and irritation
have subsided, we may be certain that there is a fracture.
We believe that this phenomenon may even lead to the
presumption of the existence of a fracture without displace-
ment.

The signs of fracture of the neck of the femur may,
therefore, be briefly stated to be,

1st. The shortening of the limb, and an approximation of
the trochanter major to the crest of the ilium.

2d. The rotation of the limb outwards.

3d. The facility of restoring the limb to its natural length
and direction, by slightly extending it, and rotating it in-
wards.

4th. The small circle, of which the motion of the tro-
chanter, produced by rotating the limb, forms an arc.

5th. The impossibility of bending the thigh upon the
pelvis, while the leg is extended.

After a severe contusion of the ilio-femoral joint, the po-
sition of the patient is the same as in fracture of the neck of
the thigh-bone; but the want of shortening of the limb, and
the movement of the trochanter major in an arc of a circle,
of which the neck of the femur is the radius, sufficiently
distinguish contusion from the injury of which we are treat-
ing. However, these signs cease to be characteristic, if
there be no displacement of the broken portions.

It is impossible to confound luxation of the thigh down-
wards (whether it be inwards or outwards) with fracture of
the neck of the bone. In the two first cases, the limb is
lengthened; in the third, it is shortened. Luxation upward
is accompanied with shortening of the limb, but in a much
greater degree than takes place in fracture. In both acci-
dents, there is an approximation of the trochanter major to
the crest of the ilium; but, when there is luxation, we can-
not restore the limb to its natural length, as in fracture, ex-
cept by very powerful extension and counter-extension. In
luxation upwards and inwards, the point of the foot is turned
inwards; the limb is fixed in this position, and cannot be ro-
tated outwards. In some rare cases of fracture, the limb, it
is true, acquires the same position; but then it can always

be easily rotated and restored to its natural length; and, moreover, the projection of the femur before the horizontal branch of the triceps, is sufficient to characterize the former accident.

Diseases of the os innominatum, or of its articulation, may lengthen the limb, by thickening the bone, or changing its situation. In the first case, the lengthening of the limb distinguishes the disease from fracture; and, in the second case, although the limb appears shortened, the trochanter and the iliac crest preserve their natural relations; besides, the shortening of the limb cannot be removed, and rotation readily takes place. Except, therefore, in those very uncommon cases where no displacement of the fragments takes place, there is not the least difficulty in distinguishing fracture of the neck of the femur from every other accident; and this difficulty cannot last more than two or three days at farthest, and these should be employed in discussing the inflammation.

Some authors believe that fracture of the neck of the thigh-bone never unites, and others, that it is necessarily followed by a shortening of the limb.

It cannot be denied, that sometimes fractures of the neck of the thigh-bone do not unite; it has even happened that the superior fragment has become almost absorbed, and the articulation filled with sanious and fatty matter. We have seen one case of this kind, in which not only this destruction of parts took place, but there were in the joint, pieces of bone mixed with an oily sanies. It is remarkable that this destruction is very different from that which takes place from aneurismal tumours; the former process seems to be more mechanical, and to result from a greater diminution of the vital powers. Nothing like it is seen after other fractures, in which no bony union has taken place, from the bones not having been kept gently in apposition; on the contrary, union takes place through the medium of a ligamentous substance. A preternatural joint may thus be formed; but, if we except some uncommon cases of fracture of the neck of the humerus, the fragments are never destroyed; nor do we find their ends covered with the wreck of their own substances, as in the cases of which we are speaking. It is also remarkable, that all the cases of want of union of fractures of the neck of the thigh-bone that have been cited by others, or which we have witnessed, have occurred in persons advanced in age; and that almost all of them have shown evident symptoms of scurvy. Can

any conclusion, as to the possibility of re-union in any case,
be drawn from such facts? Were not all these patients in a
situation unfavourable for the union of a fracture? More-
over, these cases occurred at a time when the mode of re-
taining the fracture reduced was unknown; or were noticed
by persons who, believing in the impossibility of a re-union,
took no pains to produce it. There are examples of a re-
union of the neck of the femur by an intermediate liga-
mentous substance, which has been mistaken for bone in a
diseased state: sometimes it has occupied the whole breadth
of the fractured surface; at others, only a small space, but
retaining the fragments firmly together. Lastly, in cases
where the continued friction of the fragments has nearly
destroyed one of them, we find generally the periosteum,
or rather the capsular expansion which covers the neck of
the femur, of a ligamentous density and consistence: by
these means the pieces are often kept together, so that the
patient can walk. This kind of union has been observed
under the same unfavourable circumstances which we have
mentioned in the former case, and which have given rise
to the opinion, that it was the only union which could
take place after a fracture within the capsular ligament.
The analogy between this phenomenon and the ligamentous
union of a fracture of the patella, leads to this conclusion,
that the difficulty of retaining the fragments together, after
a fracture of the neck of the femur, renders the formation
of a preternatural joint much more liable to occur than in
any other case.

Public collections, and cabinets of pathology, are filled
with specimens, which demonstrate the possibility and fre-
quency of an immediate union of fractures of the neck of
the femur.

Besides the principal nutritive artery, which enters the
femur at its posterior part, this bone receives others, that
penetrate the spongy tissue of its extremities, and spread
over its surface; the fibrous tissue that is reflected from
the capsular and the round ligament, contains others, which
go to the head of the femur. It cannot, therefore, be said
that these parts want sufficient vitality and vascularity for
re-union; but the nutrition of the upper fragment is more
or less weak, if the capsular ligament have been torn.
Hence we see, in the morbid specimens, that the lower
fragment is swollen, and covered with osseous stalactiform
processes, while the upper fragment is nearly absorbed.

As to the opinion of some, who think it impossible to

cure this fracture without deformity, we shall be able to
appreciate its value, if we make a hasty survey of the treat-
ment which has been employed at different periods. This
may be distinguished into three kinds: 1st. That which
consists merely in circular compression; 2d. That which
consists in frequent reductions; and, 3d. That in which the
limb has been subjected to the action of permanent exten-
sion. The first, it is evident, can have little or no effect,
on account of the depth of the bone.

It was once thought that, as the shortening of the limb,
after fracture, was produced by muscular action, frequently
repeated extension would produce a durable coaptation, by
fatiguing the muscles and destroying their action. This
method was adopted by men of great merit, and approved of
by the Academy of Surgery. M. Sabatier has seen frac-
tures treated in this way, which did not unite in eight or
ten months. Certainly imperfect cures, obtained by such
means, should not prejudice us against the possibility of
uniting it by a better; but there are cases in which the
neck of the thigh-bone, after being broken, has become
consolidated, even under this imperfect treatment, and in
old patients, which abundantly establishes the possibility of
obtaining a perfect consolidation of the fracture of which
we are treating.

Nevertheless, it must be confessed that fracture of the
neck of the femur is a very serious accident, especially if
very near the head of the bone. The weak vitality of the
upper portion renders the union difficult, particularly in
aged patients; and if the coaptation be not exactly main-
tained, union will not only be delayed, but may take place
through the medium of a ligamentous substance. Under a
combination of unfavourable circumstances, even in simple
fracture, the cure may be impossible; and a disease of the
joint may be brought on, which will prove fatal.

There is no difficulty in giving the limb its natural length
and direction; but it is not easy to bring the bones into co-
aptation, nor have we any means of knowing when they are
so. The fibrous covering around the neck of the femur is
generally more or less torn, and the direction of the ex-
tension and counter-extension is not parallel to the fractured
bone. On these accounts, they are with difficulty brought
into coaptation. Extension and rotation of the limb to its
proper length and direction, will certainly bring the frag-
ments into contact, but do not necessarily produce a coapta-
tion. This, however, is not essential to the consolidation of
the fracture. If the bones touch in any part of their frac-

tured ends, there is every probability of their re-union;
and we may be certain that they do touch, when the limb is
restored to its natural length and direction.*

Notwithstanding the great number of muscles which sur-
round the limb, it is brought to its natural length and direc-
tion by very moderate force. The patient being laid on his
back, one assistant steadies the pelvis, a second takes hold
of the foot, and draws it downwards very gently, and, at the
same time, rotates it inwards. To facilitate this last part of
the reduction, the surgeon, placed on the outside of the pa-
tient, also raises the trochanter major, and brings it for-
ward, so as to remove the tension of the capsular ligament.
The advice given by some practitioners, to carry the upper
part of the thigh outwards, by pressing against its internal
and upper part, in order to prevent the fragments from rub-
bing against each other during the extension, is altogether
useless. We have shown that the displacement cannot be
extensive; and, moreover, the force is not great enough to
carry the femur inwards, so as to occasion an injurious
grating of the fragments on each other.

But it is as difficult to keep the fracture reduced, as it is
easy to reduce it: as soon as the extension ceases, the action
of the muscles displaces it. Lateral compression, which acts
only on the circumference of the limb, is here altogether
useless: the fracture is situated so high up, that the appara-
tus cannot surround it; and the muscles, which have the
greatest agency in displacing the fracture, are so placed,
that their action cannot be repressed by any bandage.

Reason and experience must soon have suggested to ob-
serving practitioners, the idea of continuing the extension
and counter-extension, by a permanent force, during the
whole time necessary for the consolidation of the fracture.
This was, in fact, tried at a very remote period, and it is
doubtful if we know all the means that were employed in
order to attain this object.†

* Although Hippocrates has not, in the exact words, spoken of frac-
ture of the neck of the femur, there can be no doubt, from several pas-
sages in his article on fractures of the thigh, that he had seen it. It is
not improbable that the following passage is founded upon positive know-
ledge of the nature of the accident: " *Sed et omnia ossa tardiùs corrobo-
rantur, si non secundùm naturam posita fuerint, itemque ea quæ non in eâ-
dem figurâ quiescunt; et calli quoque debiliores ipsis obducuntur.*"—Vers.
Vanderlindenii, lib. de Fract. XXV.

† It is probable, for example, that we do not find in Hippocrates all
that was known, in his time, of the proper means of maintaining reduced
a fracture of the femur: this, at least, seems to result from several pas-
sages, which we shall here cite: " *Carnes deligationem superabunt, non ab
ipsâ superabuntur. In eo igitur, de quo agitur, intensio valida fieri debet,*

As nothing can prevent the constant tendency of the muscles to shorten themselves, some means of opposing it are therefore necessary, or their points of insertion must be approximated. The last method, which alone is effectual, was forgotten, merely because no means were known by which it could be practised. In order to estimate the value of the different methods of treating fractures of the femur, we shall first inquire if permanent extension be practicable, provided it be supportable. We shall then call to mind what we have said of the qualities which every apparatus should possess, and examine if these qualities are united in any of the different apparatus that have been devised.

In order to judge of the possibility of exercising permanent extension of the thigh when the neck of the femur is broken, we must not forget that the desideratum is to prevent the fractured pieces from moving, and to hinder the muscles from shortening the limb. After the first days, the muscles have not any other tendency to shorten themselves than that which arises from their elasticity. This is very different from their contractility or irritability, and a very moderate force is sufficient to overcome it; and the coaptation of the broken bones removes the irritation which their displacement excites, and would otherwise keep up for a long time.

In treating generally of the means of keeping fractures in place, and favouring their consolidation, we have reduced to five, the essential qualities of every apparatus for permanent extension.

1st. To avoid compressing the muscles which pass over the fracture, the elongation of which is necessary to the reduction.

2d. To distribute the extending and counter-extending forces over as large a surface as possible.

3d. To cause them to act as nearly as possible in the direction of the injured limb.

4th. That they act slowly and almost insensibly, and that their power may be graduated.

sic nullam ut in partem vertatur, nihilque deficiat.——Magnum enim dedecus *est ac detrimentum, femur brevius efficere*——*Sanum enim crus longius est, et id* redarguit. *Quare utilius fuerit,* ut si quis malè curandus sit, *ambo potiùs crura fracta habeat,* quàm alterum tantùm."—De Fractur. XXIII. How could this result be so disgraceful to the surgeon, if it were common? In the same book, Hippocrates describes an apparatus for permanent extension of the leg. How could the necessity of a similar treatment of the thigh have escaped observation, when the few cases are mentioned in which it is proper in fracture of the leg?

5th. That the parts on which they act, be protected from
hard and unequal compression.

Let us now inquire how far these qualities are united in
any apparatus now in use. We are, first, to consider the most
ancient treatment, which is at once described and censured
by Hippocrates, and which consisted in tying the foot to the
foot-board of the bed : " *Neque*," says he, " *ad rectitudinem
quicquam prodest, sed etiam obest. Dum enim vertitur, reli-
quum corpus aut hac, aut illac, nihil prohibebit vinculum
illud, quo minus et pes, et ossa pedi annexa, reliquum corpus
sequantur.* IMÒ SI PES ALLIGATUS NON FUISSET, MINUS
DISTORQUERETUR."* Nothing can be added to increase the
value of these remarks, nor is it destroyed by the change
which this process afterwards underwent. It is the same
which Guy-de-Chauliac described from Roger, except that
there are, in the last, some imperfections not in the former :
it wants a counter-extending power, and there is nothing to
prevent the patient from slipping down the bed, when the
extension is applied by the pulley and rope, one end of
which is fastened to the limb, the other to a weight.

Before the time of Desault, counter-extension was made
by a hand fastened to the head-board of the bed. We shall
not fill our pages with a description of the different means
of making permanent extension, employed by Hippocrates,
Hildanus,† Belloc, Gooch, and Aiken. None of these ap-
paratus prevent rotation of the limb outwards ; and, more-
over, the muscles passing over the fracture are compressed,
the force of extension and counter-extension is supported by
a small space, and the parts are not sufficiently protected by
compresses. The methods of Belloc and Gooch have a fur-
ther inconvenience, which is, that the extension, being sup-
ported by the sides of the knee and foot, or by the knee
alone, is not counterbalanced by the ischium, to which the
counter-extension is applied ; so that its point is the only one
which resists the shortening of the limb.‡

* Lib. de Fract. XXXII.

† We cannot avoid noticing here an historical error. Hildanus recom-
mends, for fractures of the lower and middle parts of the thigh, a splint
capable of being elongated by means of a double screw ; and which, being
placed on the internal part of the thigh, makes the extension by means of
a strap above the knee, and another below it ; and the counter-extension,
by pressing against the os pubis. This must not be confounded with the
wrought-iron splint, which he advises for fractures of the upper part of
the femur, and which we shall hereafter describe.

‡ We have not mentioned Avicenna among the authors who have recom-
mended continued extension, because the passage, in which he is thought,
by some, to refer to this process, appears to me to relate to other subjects.

There is only one known process by which rotation of the limb outwards is prevented, which is that of Bruninghausen; but, unfortunately, he neglects all means of obviating the shortening of the limb, and even gives the name of *reduction* to the simple rotation of the foot inwards. " This," says he, " is the most essential part of the treatment, and that which has been most neglected." There is too much truth in the latter part of this observation; for, although every practitioner regards rotation inwards as an uniform characteristic of this fracture, yet no one before Bruninghausen endeavoured to prevent it. The thigh is so convex in front, and so broad below in its lateral diameter, that, when the knees are brought together, the part of the bone above the point of contact, is, at the same time, before it; so that the limb being rotated inwards, and fastened to that of the opposite side, directly above the knee, rotation outwards is prevented, as well by the resistance of the condyles of the sound side (which tend to pass inward, because the middle, and most curved portion of the femur retained by the ligature, cannot turn out), as by that of the posterior part of the ilio-femoral capsule. Thus the femur may be considered as a double lever of the second kind, the moveable portion of which is the most arched part of the bone, precisely that to which the bandage is applied; the points of support of the two levers, are the posterior end of the external condyle, and the part equidistant from the trochanter major and the surface of the fracture; lastly, the resistance represented by the weight of the limb, is half way from the extreme points and the point of coincidence of the two levers.

In order to give more stability to his bandage, Bruninghausen fastened it to a leather splint, the upper end of which passed around the pelvis; and, to hinder the limb from being bent, he tied the feet together. These means he afterwards abandoned; and it is easy to see how ill they are adapted to answer the purpose for which they were intended: it must, at the same time, be allowed, that nothing can be better calculated to prevent rotation of the limb outwards. But it does not appear that constant pressure of the knees against each other, is either necessary or supportable; on the other hand, the total neglect of extension and counter-extension, and constantly keeping the limb rotated inwards, tend to increase the shortening, unless the fracture be within the capsule.

In the year 1777, Vermandois, a very excellent and modest surgeon, invented a process, which, if it did not answer the

end proposed, was at least devised with a perfect knowledge
of the indications to be fulfilled. He considered broad splints
as best adapted to prevent the rotation of the limb outwards :
the ankle was fastened to two splints, and the extension very
properly made in the direction of the axis of the limb : coun-
ter-extension was effected by two splints, the outer of which
pressed against a cup of iron fixed to a band of leather, and
the inner into another cup fastened to the same girdle, under
the thigh. He afterwards simplified his method of making
the extension, by passing a band over the groin, and obliquely
upwards, to the superior part of the outer splint. This pro-
cess differs very little from that of Desault, except in the
oblique direction of the two heads of the extending bandage,
which are carried towards the lower end of the outer splint.

These two practitioners deserve great praise for having
first discovered the method of applying continued extension
by a simple process, which acts on the two ends of the frac-
tured limb, and as nearly as possible in the direction of its
axis. But Vermandois alone perceived the necessity of pre-
venting the limb from rotating outwards, though he did not
effect this object. Desault, on the other hand, appears to
have entirely overlooked it ; for, in fact, his apparatus in-
creases the rotation outwards, which it is so essential to
prevent. Both applied sufficient force to keep the bones im-
moveable ; but the powers they employed cannot be gra-
duated at pleasure. Lastly, their extension and counter-
extension are not applied to a surface sufficiently large, and
the parts are not sufficiently protected, by soft substances,
from injury.

Such is the state of this part of surgery at the present
time. We may readily see why the extended position of the
thigh is not always successful, and why some practitioners
of great merit have abandoned it entirely : hitherto, no ap-
paratus has been invented which unites all the conditions ne-
cessary to its success. We have endeavoured to combine all
the essential qualities in a process which we have had very
frequent occasion to employ, and we are assured that, if it
have not all the advantages that could be desired, it answers
all the most important indications. It is not, indeed, suffi-
ciently simple to be in common use ; but it keeps the frac-
ture in a more steady and exact apposition than can be
obtained by any other means.

The apparatus consists of a machine, composed of a splint,
a foot-piece, and a thigh-strap.

The splint is four feet long, two inches and a half broad,
four or five lines thick, and made of strong and somewhat
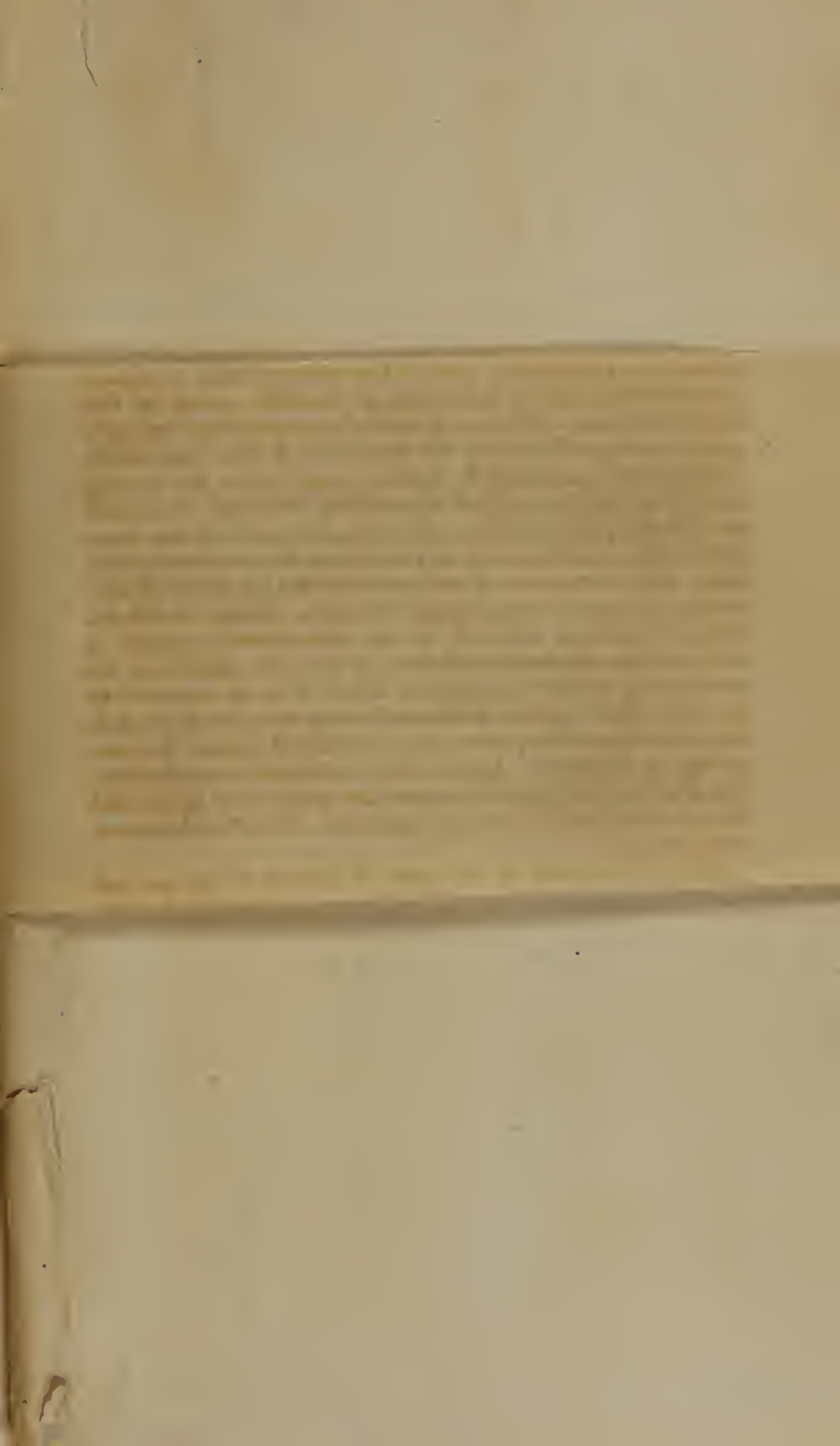
PLATE II.

Represents a Machine for constant Extension of the lower Extremities.

Fig. 1. The inner side of the splint.
  a a. An opening or cleft extending through the lower third of its length.
  b b. A regulating screw.
  c c. The square end of the screw, to which is fitted a wench to turn it.
  d d. A moveable box or nut, having an opening through which passes the
    screw, covered with two plates that slide on the sides of the splint.
  e e. Legs.
  f. The upper end of the splint.
Fig. 2. The thigh strap.
  a a. Its middle portion stuffed.
  b. Its end armed with a strap.
  c. A buckle at the other end.
  d. A pocket, opening downwards, to receive a sort of crutch at the
    upper end of the splint.
Fig. 3. The foot piece.
  A. The plate of the sole.
  B B. A split piece of raw sheep-skin.

Fig. 1

Fig. 2

Fig. 3
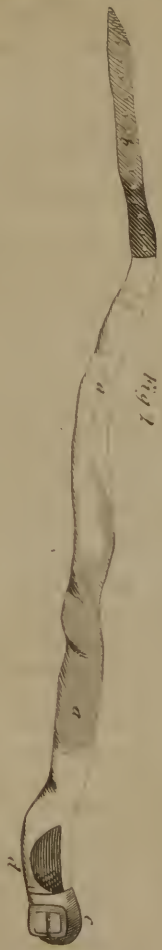
flexible wood. An opening, or cleft, extends through half
the length of the splint; the end of this is armed with an
iron trimming. This trimming represents three sides of an
oblong square, and encloses the sides of the splints, to which
it is attached by screws. In the opening of the splint a
box is made to slide by means of a regulating screw, which
passes through its centre. The regulating screw extends
through the whole length of the opening or cleft in the
splint; and one end is made square, so as to be turned by
a key; the other end of the regulating screw revolves on a
plate of iron at the bottom of the cleft. To the sides of the
box are attached two square plates of iron, which slide in
the sides of the splint. The two plates and the box have an
opening perpendicular to that which receives the regulating
screw; into this opening passes a hexagonal nut, by means
of which a piece of iron (intended to support the foot-piece
when the machine is in use) is fastened to the innermost of
the two plates. This piece of iron is formed of two parts
united at a right angle, one of which is parallel, the other
perpendicular to the side of the splint. One of these parts
is square, and has an opening, into which passes the screw
that traverses in the box, to the internal plate whereof it
is thus fixed. The second part is about six inches long, and
two thirds of an inch broad; it has an oblong opening to
receive a tenon of the foot-piece. Near its ends are two te-
nons and thumb-screws; the former pass through mortices
in the legs or supporters, which are secured by the thumb-
screws. The legs are six inches long, and curved, their con-
vex surfaces facing each other.

The upper end of the splint is armed with a piece of iron,
on the middle whereof is a tenon, in which is engaged the
horizontal part of a crotchet, constructed as follows:—It is
composed of two parts, which unite at a right angle. One
of these parts is vertical, parallel to the plane of the splint,
one inch and a half long, and of a semicircular form: it is
received into the pocket of the thigh-strap. The other is
horizontal, and perpendicular to the plane of the splint; it
is three inches long, and has a longitudinal aperture, into
which the tenon of the upper end of the splint is received;
and the crotchet is retained in the place judged proper, by
means of a thumb-screw.

The foot-piece is of wrought-iron, covered with chamois
leather, and furnished with a broad strap of soft skin, split,
almost throughout its whole length, into two narrow straps.
These pass around the foot and leg, so as to confine the for-
mer to the foot-piece. On that side of it which is towards

the lower end of the splint, are two tenons, placed in the same vertical line, and one of which is engaged in the oblong aperture of the plate of iron which connects the supporters, so that the foot-piece may, by means of a thumb-screw, be retained at a greater or less distance from the splint. The horizontal plate also admits of being inclined in such a way as to rotate the foot-piece inwards or outwards.

The thigh-strap is formed of two straps of strong leather, united at an acute angle. These are two finger-breadths wide, covered with sheep's skin, and well stuffed. One is long enough to pass obliquely around the upper part of the thigh; the end is not stuffed, but has small round holes. The other strap is three inches long, and has a buckle at its end. On the external side of the thigh, where these two straps unite, is firmly fixed a semicircular piece of thick leather, that forms a pocket opening downwards, and into which is received the vertical portion of the crotchet.*

To apply this machine, we are to place under the limb the piece of linen in which the splints are to be rolled, and five common bands, three under the thigh and two under the leg; a cushion stuffed with cotton, as long as the thigh-strap, and about three inches broad; this must be applied so as to bear exactly upon the ischium, and not upon the internal side of the thigh. Care must be taken to give the thigh-piece, and the cushion placed beneath it, a direction nearly vertical, that they may not become displaced, and press out the internal side of the thigh : when this takes place, the constant pressure will produce ulceration of the integuments, and even of the muscles. In the next place, the sole of the foot and the lower part of the leg are to be adjusted with wads of cotton, and the foot-piece is to be applied, the two straps of which are to be passed obliquely around the leg. These straps not being sufficient to secure the foot-piece, it is further proper to pass a band, about two yards long, around the lower part of the leg, the strap, and the foot-piece. The fracture is now to be reduced, according to the principles already laid down. The crotchet of the upper end of the splint being then adjusted in the pocket of the thigh-strap, the regulating screw must be turned to the left, until the box is raised sufficiently for the foot-piece to be attached to the iron plate which connects the extremities of the supporters. By turning the screw to the right, the box and foot-piece are brought down towards the end of the
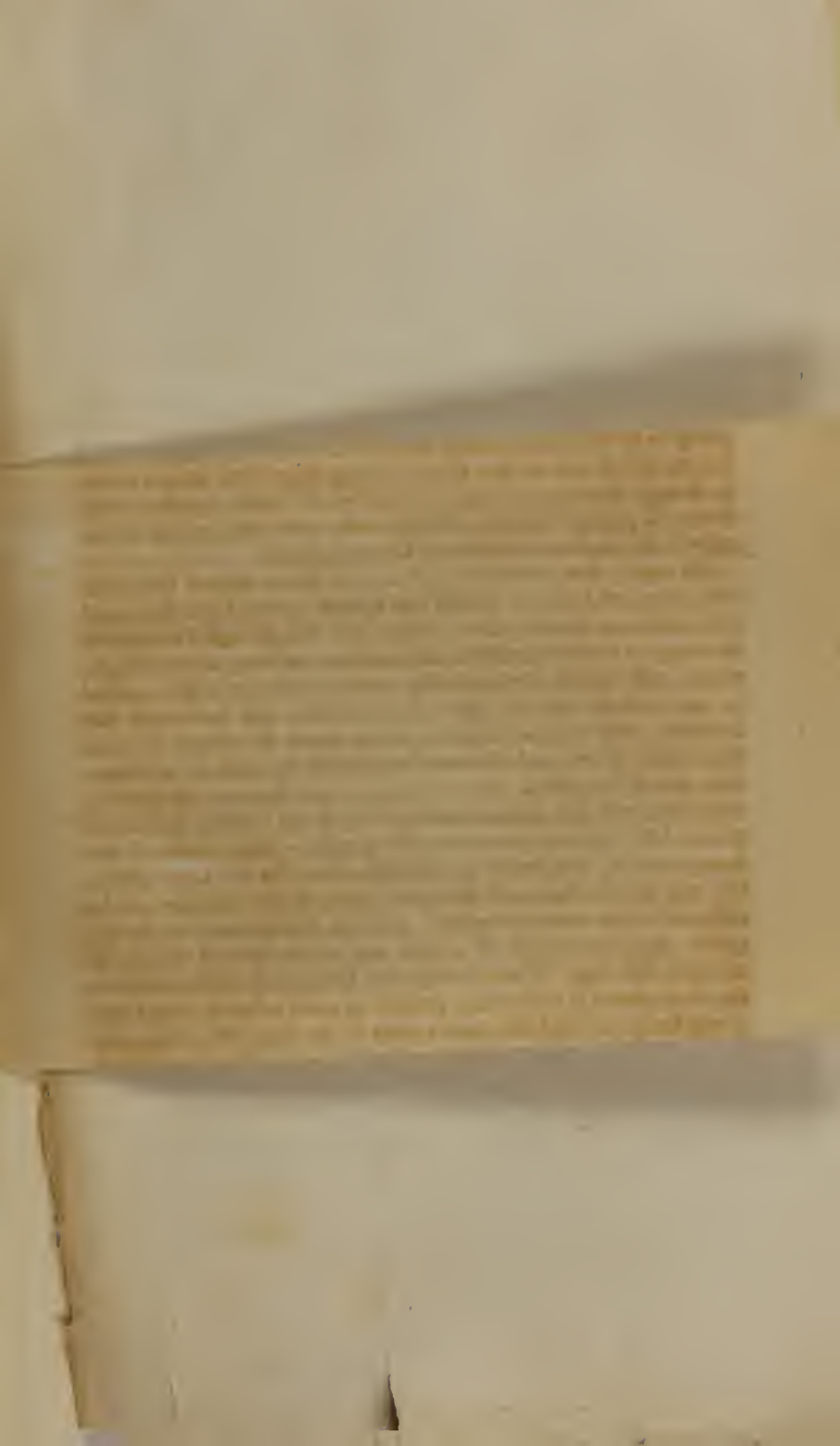
PLATE III.

Fig. 1. The apparatus applied.

    a a a a. The fractured limb.

    b b b. The machine for constant extension.

    c c. The regulating screw.

    d. The wench to turn the regulating screw.

    e e. The square box through which the screw passes, and which slides along the splint.

    f. The crutch which passes into the pocket.

    g. The thigh-strap *in situ.*

    h h h h. The anterior splint.

    i i i i. Bags of chaff.

    k k k k. Bands to tighten the apparatus.

    l. A foot piece to which the foot is fixed.

    m m. Its legs.

Fig. 2. A front view of a patella which, after having been broken, has united by an osseous medium. (See Plate IV. Fig. 1.)

    a b. The ends of the transverse fracture.

    c d. The two fragments inclined toward the point *b.*

    e. Traces of a longitudinal fracture.

    f. A part near the greatest breadth of the callus, that has not united.

    g h i. Irregularities which seem to depend upon the ossification of a part of the tendon of the extensor muscles of the leg, and of the fibrous tissue that covers the anterior surface of the patella.

Fig. 1.

Fig. 2.

splint: thus extension is made, and the pressure of the crotchet of the splint upwards, stretches the thigh-strap, fixes the pelvis, and makes the counter-extension. Bags of chaff are then to be placed under the internal and anterior splint, between the machine and the external part of the limb, and between the posterior part of the limb and the splint-bands, and the whole to be rendered secure by ribbons.

Now, if we examine the effects of this apparatus, we shall see,

1st. That it makes the extension and counter-extension upon parts distant from the fracture, and, consequently, that it does not irritate the muscles which pass over it.

2d. That the extension and counter-extension are distributed over as large a surface as the structure of the parts permits: thus the force of the extension is applied to the whole surface of the lower part of the leg and foot. The thigh-strap acts upon the whole region of the ischium, and is free from the disadvantage of linen bands, which fall into folds, and slip off from the cushions that are placed under them.

3d. Extension and counter-extension are, as nearly as possible, made in the direction of the axis of the limb: the extension is exactly parallel to this axis, and the small degree of obliquity of the counter-extending force is inevitable, from the structure of the parts. It is easy to perceive that the projection of the crotchet, which may be increased at pleasure, so as to profit by the depression below the os ilii, renders this obliquity less than that of any other apparatus.

4th. We can regulate the extension and counter-extension at pleasure, and by almost insensible degrees: we should, however, be on our guard lest the patient secretly loosen the buckle of the thigh-strap.

5th. The parts are sufficiently protected from the effects of unequal pressure.

6th. The rotation of the limb outwards, and its shortening, are prevented—an advantage which seems to have been totally forgotten in the treatment hitherto pursued.*

But we are far from denying that permanent extension is unaccompanied with difficulties, or that a fracture of the neck of the thigh-bone can be united as exactly as any other fracture. The counter-extension cannot be made perfectly parallel to the axis of the limb, without putting a splint on the inside, the pressure of which upon the ischium, experi-

* See note C

ence has proved to be insupportable; neither are there any
means of rendering the pelvis perfectly immoveable, for the
bandage, which is passed around it and the upper extremity
of a long splint, does not effect this object. Lastly, the calls
of nature prevent us from keeping the limb perfectly at rest.

Hence the fragments become more or less displaced, even
after the application of the apparatus: their re-union may
be thus retarded, and it is never perfect in the ordinary
time; and, even after several months of rest and judicious
treatment, when the limbs appear equal, and the re-union of
the fragments solid, the moment the patient begins to walk,
the limb gradually becomes shortened. There are, more-
over, persons whose skin is so delicate and sensible, or pos-
sesses so little vitality, that compression causes insupportable
pain, or mortification of the integuments. From the first of
these causes, permanent extension may be inapplicable to
women; and, from the second, to aged persons, and those
who are exhausted by previous disease.

Whatever process we employ, we should pursue it with
care, and always protect the soft parts from the consequen-
ces of too great or unequal pressure. Mortification is not
an unfrequent result of neglect of this precaution; but we
may say, with Celsus, " *Non crimen artis, quod professoris
est.*"

It is almost always necessary to delay the reduction of
the fracture for seven or eight days, or even longer, if the
irritation of the parts, and spasms of the muscles, have not
subsided.

After the reduction, we should be particularly careful to
keep the fracture as much at rest as possible, by enabling
the patient to lift his body, for the calls of nature, by means
of a cord suspended over him, while his thighs are raised by
a bandage passed under them.

The bandages also become loose, and require to be fre-
quently tightened, especially from the forty-fifth to the six-
tieth day. After sixty or seventy days, rest alone is neces-
sary; and this should be continued for six weeks, or two
months, according to the age and health of the patient, and
the firmness of the union; then the extending apparatus is
discontinued. When the patient can bend the thigh upon the
pelvis, with the leg extended, he may cautiously begin to
walk with crutches; if walking prove painful, he must keep
his bed for some time longer.

Scarcely any degree of stiffness takes place in the articu-
lation of the thigh with the pelvis, but there is always more
or less in the knee and ankle.

Although some persons cannot support the degree of extension necessary to give the limb its natural length, yet such a degree of force as will prevent great displacement of the fragments, can almost always be employed with advantage, even though, in some few instances, the rotation of the limb outwards be all that we can remedy. Lastly, if continued extension be insupportable, or inadmissible even in this moderate degree, we may employ the ordinary treatment for fracture of the body of the femur.

Fractures of the femur, even when improperly treated, are not necessarily followed by great deformity; those within the capsule often unite without much shortening of the limb. We have seen fractures of the neck of the femur, which were mistaken for contusions; and the patient having merely been kept at rest, the limb united, but with shortening, and rotation outwards.

We shall not enter into long details respecting the separation of the head of the femur, which differs in no respect from fracture.

Paré has described the symptoms of this accident, and states, that it may be mistaken for a luxation. This accident can only happen in early life, while the cartilage is of some thickness, long before the epiphysis is identified with the rest of the bone. Though the line of separation is distinct at eighteen or twenty years of age, this accident always occurs in persons much younger.

The causes that are capable of producing fracture of the neck, may also separate the epiphysis. But if a fall on the side produce neither of these accidents, and the patient be young, the three bones which form the os innominatum, and which meet in the centre of the acetabulum, may be separated. Ludwig relates a case of this kind.

Excepting crepitation, the signs of separation of the epiphysis are the same as those of fracture of the neck of the os femoris. The union, in the former case, is much more easy.

We shall terminate this chapter with the following case, to confirm the propositions it contains, and especially to illustrate the utility of permanent extension.

A printer, thirty-two years of age, was thrown upon the pavement by a horse: he fell on his side, and could not raise himself. The day after the accident, he was brought to the hospital, and I discovered a fracture of the neck of the femur. As there was much inflammation and tension of the parts, I directed emollient cataplasms, rest, and the antiphlogistic regimen. On the eighth day I applied my

apparatus, by means of which, in a short time, the limb was restored to its natural length. Pretty severe pain came on, and continued for the first ten days, but afterwards it subsided. On the twelfth day, the stomach became disordered, and an emetic was prescribed, with good effect. On the eighteenth day, the bands having become relaxed, a little shortening of the limb was perceived. I increased the extension ; the pain in the limb returned ; but, in three or four days, it ceased. On the sixtieth day, the apparatus was removed. The limb preserved its natural length and direction, and the patient soon after left the hospital, entirely cured.

CHAPTER XIV.

Of Fractures of the Patella.

F RACTURE of the patella is almost always transverse, rarely oblique, and still more rarely longitudinal. Sometimes the bone is divided in three or four pieces, and as it were comminuted.

Longitudinal fracture is always caused by external violence, and is accompanied with wound, contusion, or effusion of the blood into the articulation. Transverse fracture is sometimes occasioned by the same cause ; but it is generally produced by violent contraction of the extensor muscles of the leg, and this may be occasioned without the muscles being convulsed : we know, from experience, that these muscles, in their natural state, when the body is inclined backward, and a fall on the occiput is likely to happen, are capable of producing it. In this case, the thigh being bent, the extensor muscles of the leg contract, bring the body upright, and prevent a fall backward : the posterior surface of the patella then rests only upon a point on the anterior part of the condyles of the femur, and is placed between the ligament of the tibia and the action of the rectus and triceps cruralis muscles. If this action be stronger than the resistance of the patella, the continuity of the bone will be destroyed. The accident, in this case, happens the more easily, as, by the flexion of the thigh, the line of direction of the extensor muscles of the leg, and the ligament of the patella, is oblique, in respect to the vertical axis of this bone : so that these two powers, one of which acts upon the

superior, and the other upon the inferior part of the patella,
bend it backward directly at its upper part, which rests
upon the condyle of the femur: such is the mechanism by
which muscular action produces fracture of the patella.

It has been asserted, that dancers were particularly liable
to fracture of the patella; but experience does not prove
that they are more subject to this accident than persons of
any other profession. The strain which the muscles exer-
cise on this bone, while the leg is in a state of perfect
extension, may, however, produce a rupture similar to that
of a cord that is violently stretched. Thus fracture of the
patella has occurred during a convulsive fit, while the pa-
tient was laid on his face. But it is astonishing, in this case,
that the patella can be exposed to such incalculable force as
would be necessary to produce a fracture in this manner.

There is no doubt that the causes which act directly on
the patella, are capable of occasioning a solution of conti-
nuity. Thus a fall, or a blow on the knee, may produce a
fracture of this bone; but for a fall to produce the effect,
the leg must be very considerably bent, and the patella car-
ried as low as possible. In fact, the constant tendency of
the muscles to contract, and the resistance of the inferior
ligament of the patella, keep this bone at an equal distance
from the tibia, of which it follows all the movements, vary-
ing its position only in relation to the condyles of the femur.
Now when the leg is bent to a right angle with the thigh,
the patella is so situated, that a fall on the knee would
merely press up the inferior part of this bone, and distend
its ligament. In a greater degree of flexion of the leg, the
patella is drawn to that point of the knee which ought to sup-
port the whole weight of the body; and, in this case, it is
exposed to all the violence of the shock. It has been said,
that, in falls on the knees while they were bent, the patella
rested on the femur above, and on the tibia below; and that
a transverse fracture was thus rendered easy, by its want-
ing support in the middle. But, if we examine attentively
the relations of these three bones in strong flexion of the
leg, we shall see that the patella cannot be placed in contact
with the superior part of the tibia; and that it constantly
rests, in its middle part, upon the condyles of the femur,
balanced between the resistance of the inferior ligament
and that of the muscles. The fracture, therefore, must take
place opposite to this part. Now, if we reflect upon the
manner in which violent contraction of the extensor muscles
of the leg is excited by the spontaneous effort of self-preser-
vation, we shall see both the direction in which the violence

acts, and that in which the fracture will probably take place, when it arises from this cause; at the same time, it is evident that a fall on the ground, or a blow on the patella, may cause oblique fractures, and particularly longitudinal fractures; these cases, however, are very rare. In these instances, the severity of the contusion, the exposure of the joint, or the effusion of blood into it, often leads to the necessity of amputation.

Commonly when, by the fall which has been the cause, or the effect of the fracture, or by imprudent movements made to ascertain the nature of the accident, the limb has not been placed in a state of extreme flexion, the aponeurotic, or fibrous expansion, which covers the anterior part of the patella, is preserved, either wholly or in part, and the fragments are thus kept within a moderate distance of each other. We shall see hereafter, that the accident, in this case, is far less serious than when the bones are separated a great distance from each other.

Whether there be rupture, or extension only, of this aponeurosis, a certain degree of irritation and tumefaction always results, which requires our first attention, as it prevents the application of the means for keeping the bones reduced.

There is always considerable separation of the fragments, whatever be the deviation in which the bone is broken: it may extend so far as several inches.

Hitherto very few cases of longitudinal fracture have been noticed. Lamotte relates a case, in which he found the patient seated, and the leg slightly bent. In this posture, the fragments of the fracture were slightly separated laterally. Is this phenomenon to be attributed to the displacement which the lateral ligaments of the knee suffer in flexion of the leg, by which they are moved a little backwards; or to the tension of the anterior part of the capsule, if they be drawn in the same direction?

We may suspect a transverse fracture of the patella, if the patient being on his feet when the accident happened, then suddenly fell in consequence of it, and could not get up; if, after having been placed on his legs, he fall, the moment he attempts to advance; and if, on the other hand, holding and extending the leg with his arm, he be able to walk backward, dragging the foot upon the ground. The separation of the bones is scarcely discernible through the integuments; and the fragments are easily brought into contact, by extending the limb, and very slightly putting them together. If we then move them laterally, crepitation

will be perceived. But these signs do not exist in sufficient number to enable us to form a certain diagnosis, when there is much irritation and tumefaction. However, this is no inconvenience, because, in every instance, the first object is to discuss the inflammation before we apply any apparatus.

The imperfection of the means employed for maintaining in contact the fragments of a fractured patella, has produced cures more or less imperfect, and the bones have united at some distance from each other : hence it has been inferred that fractures of the patella did not unite like others, or not at all ; and surgeons, more occupied with physiological discussions than in observing the course of nature, have advanced as reasons for this peculiarity in the structure of the bone, the communication of the fracture with the interior of the articulation, and the dilution of a pretended osseous juice by the synovia, &c. But it is now demonstrated, that the patella has all the qualities necessary to a perfect bony re-union, except the perpetual tendency of the muscles inserted into the upper fragment to contract, and the impossibility of opposing this tendency, so as to keep the fragments in exact apposition ; they therefore unite, at some distance from each other. The mode and utility of this connexion varies, according to the greater or less exactness with which the parts have been kept approximated. This is what happens in such cases : It is not difficult to place the bones in contact, in transverse fracture, (especially when there is no considerable tumefaction) by fully extending the leg, so as to relax the extensor muscles ; and pushing down the upper fragment, while the lower is kept steady. The fatty substance behind the inferior ligament of the patella, has been falsely supposed, by some, to be interposed between the fractured bones. This idea has no foundation in fact ; yet, strange as it may appear, the bones cannot be kept in contact ; the apparatus constantly gets loose, and cannot be changed often enough to prevent this effect from taking place ; the separated surfaces of the bone, and the ruptured aponeurosis, become inflamed ; the fibrous parenchymatous substance of the two surfaces of the bone becomes enlarged and thickened ; and appears like a new formation, continuous, and of a fibro-cellular structure. Thus the fracture re-unites.

When the bones have been left far from each other, this medium of union is extremely weak ; on the other hand, it becomes exceedingly strong, if the bones have been nearly approximated.

From these observations, we see how much this accident

is aggravated by a fall the moment after it occurs, and how improper it is for a surgeon to bend the leg, in examining a patient who has suffered such an injury. The patella so rarely becomes directly united, that Pibrac challenged all the surgeons of Europe to produce an anatomical specimen of fracture of the patella consolidated by callus. It is true that the intermediate fibro-cellular substance never becomes converted into bone.

When the fragments become feebly united, and at a distance of four or five finger-breadths from each other, the actions of the extensor muscles can no longer be transmitted to the leg; these muscles become shortened, and walking is rendered difficult. We know several persons in Paris who are obliged to use a knee-cap in order to prevent flexion of the knee, and who cannot walk without the support of a cane or an arm; but when the fragments have been kept from separating from each other for a few lines, or even an inch, the use of the leg is perfectly restored. This observation should prevent us from using any apparatus which keeps the bones together with great force, and thus exposes the soft parts to all the inconveniences of too strong pressure, and brings on stiffness and long immobility in the limb. What advantage is there gained to counterbalance these evil consequences, since a less perfect union equally replaces the limb in the exercise of its functions? This remark has not escaped Bell, Pott, and Ravaton; who have observed, that, without obtaining a more perfect cure, the articulation of the knee remained much more stiff. However, we should not fall into the contrary error, but take a sufficient degree of precaution to prevent the too great separation of the fragments.

As to longitudinal fracture, we have never seen a case of it; but it is probable that the reduction of it is not difficult, and that the re-union is more exact. The patient spoken of by Lamotte, was cured in a short time; and he does not mention that there was any deformity.

Even the most simple fracture of the patella is always attended with a certain degree of irritation, which, in twenty-four hours afterwards, is followed by swelling. In every case, therefore, we should delay applying a bandage until these symptoms have abated; the contrary conduct may be followed by stiffness of the knee and false ancylosis— symptoms which have been unjustly attributed to the distillation of callus into the articular cavity.

Three essential indications naturally present themselves in the treatment of these accidents: 1st. To place the limb

in such a position, that the muscles which act upon the pa-
tella, and the ligament which unites it to the tibia, are in a
state of the greatest possible relaxation. 2d. To keep the
limb in this position by means which counteract the action
of the antagonist muscles. 3d. To press the two fragments
toward each other.

Some authors have thought that these three indications
were included in the first, and that it was sufficient to keep
the limb extended. It must be allowed, that, if the limb
could be kept extended for a sufficient length of time, the
union might, in some cases, take place; but the muscles
have a constant tendency to retract, and will not fail to ren-
der the space between the fragments injuriously great, par-
ticularly if no means be taken to prevent this retraction. In
some cases, indeed, without any other means than extension
of the limb, no solid union can take place.

M. Sabatier considers it impossible, in all cases, to keep
the limb extended. In the Memoirs of the Academy of
Sciences he states, that two patients, on whom he had ap-
plied the ordinary apparatus and extended the leg, could
not support this position, and suffered such violent pain in
the ham that he was obliged to remove the apparatus, and
place the leg in a state of slight flexion. He advises that
the patient should be placed on the side, with the thigh bent
in an acute angle with the abdomen, so as to relax the ex-
tensor muscles as much as possible, and to allow the leg to
be slightly flexed. We have observed, with M. Sabatier,
that constant extension produces severe pain in the ham;
but, with us, it has not lasted long, or obliged us to change
the position of the limb. We therefore think, if care be
taken to dissipate the inflammatory symptoms before the
application of the apparatus, we shall not be obliged to re-
move it, or to place the patient on his side; for this position
is sometimes insupportable, because the body rests on the
trochanter major; moreover, it does not allow of any ap-
plication to bring the fractured pieces together, or to oppose
the action of the flexor muscles of the leg.

Some surgeons have placed, behind the articulation of the
knee, a solid body, which prevented flexion of the leg; but
they did so, in order to protect the projecting parts of the
ham from too hard compression. Desault first showed the
utility of applying a long splint to the posterior part of the
leg and thigh. We have, for a long time, employed an appa-
ratus different from that of Desault; it is more simple,
and we think it is more sure in its action. The pieces of
this apparatus are, a gutter of wood, two straps, five or six

pieces of broad ribbon, or a roller. The gutter should be long enough to extend from the middle of the thigh to below the calf, and its sides should be high enough to embrace two thirds of the thickness of the limb; it is wider above than below, and covered on the inside with an undressed sheep's skin. About the middle of its length, the edges of this gutter present externally some round-headed nails, placed five or six lines from one another. The straps, which are an inch broad, and six or seven long, are formed, in the middle of their length, of buffalo's skin, covered with sheep's skin, and stuffed with wool, like the belt of a herniary truss: of an equal length with this piece, are two others at the ends, made of sheep's skin, with holes punched in them two lines apart. When the limb is placed in the gutter, the ham must correspond to the centre; the intervening spaces are to be filled with carded cotton. An assistant then brings the fragments together, while the surgeon passes one strap above the superior fragment, and another below the inferior, and fastens them to the nails, crossing each other: thus an elliptical space is left between the two straps, which is crossed transversely by the patella. The part is then to be wet with a resolvent liquid, and the bands passed around the gutter. This apparatus is delineated in plate III.

The advantages of this machine are, that it leaves the fractured part uncovered, so that we may judge at any time of its situation; that it exercises strong compression, without endangering mortification; and that the straps may be loosened and tightened at pleasure, without deranging the other part of the apparatus. But, in most cases, patients complain, during the first hours of its application, of severe pain where the straps press against the patella: however, the pains are soon dissipated, in many cases, without even relaxing these bands.

Fracture of the patella is ordinarily united in sixty or seventy days, with sufficient firmness to prevent elongation or rupture of the intermediate substance: in old persons, however, it is prudent to continue the apparatus eight or ten days longer.

It has been advised to move the leg at an early period, in order to prevent stiffness of the knee: this doctrine appears reasonable, and we formerly taught it; but the fear of elongating or breaking the intermediate substance, has led us to a different practice. In general, we do not permit our patients to begin to move the leg before the expiration of two months; notwithstanding this, the knee soon becomes flexible, and we have never produced a false ancylosis;
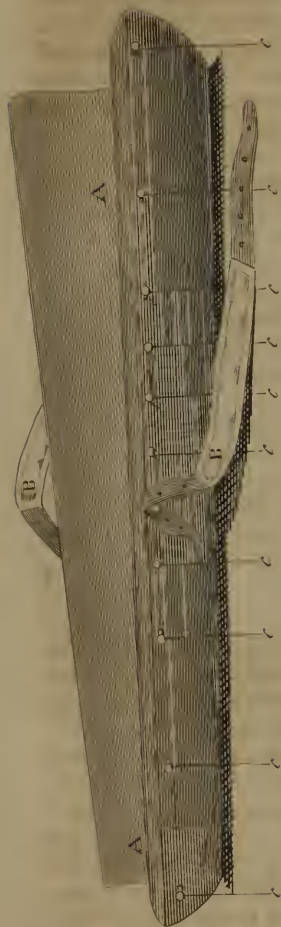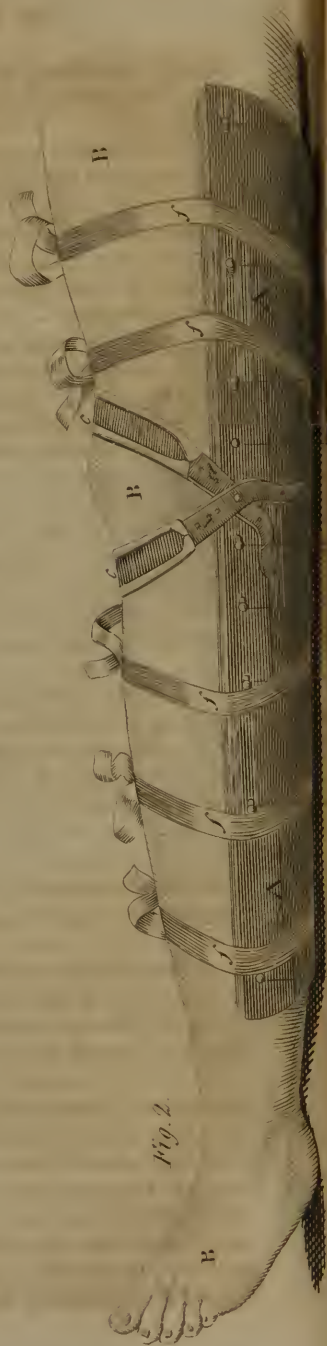
Plate 7.

Fig.1.

Fig.2.

which, moreover, is less to be dreaded than rupture, or even elongation, of the fibrous substance which unites the fragments.

When severe contusion, wound, or other complications, accompanies fracture of the patella, the case is always very serious, generally requiring immediate amputation. If the patient survive the first inflammatory symptoms, he is commonly worn down by the copious suppuration that follows, which, if it do not cause his death, renders the knee stiff and motionless.

CASE I. A man, who had danced all night, perceived, towards morning, in the middle of a dance, a dull sound in his right knee. Some minutes after, as he was walking in the ball-room, the same noise and sensation were repeated; and in an instant he fell, and could not rise. I perceived a fracture of the patella, and applied a simple uniting bandage; that is to say, two oblong compresses, one above and the other below the patella, kept on by means of a roller passing in the form of a figure of 8. This was carefully applied as often as it became loose. On the forty-sixth day, the patient left the hospital, and the fracture was firmly united by an intermediate substance some lines thick, which did not incommode the movements of the limb.

CASE II. A ticket porter fell upon the ice, and suffered a simple fracture of the patella. He tried in vain to get up, and finally reached a house about sixty paces distant, by drawing himself on his back; he was there raised up, and, resting on another person's arm, he walked backwards to his house, which was about three hundred yards off. On the next day he was brought to the hospital: great tumefaction had supervened. I applied poultices, and, eight days afterwards, began to treat it like the former case. The patient left the hospital on the forty-fourth day; the fragments were then firmly united about six lines from each other.

CASE III. A coachman, of strong constitution, thirty-six years old, sitting carelessly on his box while the horses were moving, made a violent extension of his legs to save himself from a fall; his right foot slipped upon the foot-board; he immediately felt acute pain, and heard a singular noise in his right knee; nevertheless, he drove to Paris, which was then ten miles distant. The next day I found him at the hospital Charité, with a fracture of the patella, the fragments of which were separated only an inch and a half from each other, but the soft parts were already tense and inflamed. In twelve days, the inflammation being then reduced, I applied the bandage as described above. During

the first thirty-six hours the patient suffered severe pain, which then spontaneously abated. The dressings were changed on the ninth and eighteenth days, and, on the thirty-first, they were discontinued. The fragments were only separated by an interval of one or two lines, which could not be perceived externally. The patient soon began to walk; and, on the thirty-eighth day, he left the hospital, completely cured.

Case IV. On the 27th December, a man, aged sixty-five years, in descending from the side-walk of St. Michael's bridge, fell upon his right knee, and fractured the patella transversely. He was immediately brought to the hospital Charité, where I found the fragments very much separated, and admitting several fingers between them. At first I endeavoured to combat the consequences of the contusion, and, on the eleventh day, I reduced the fragments. The limb was then placed in the machine of which I have spoken. On the first day, the pains were very severe, and I was obliged to loosen the straps. I tightened them on the day following; the pain was re-excited, but it passed away of itself. In twenty-one days, I ceased to apply the straps; and, in five days afterwards, I removed the gutter. The separation of the fragments was scarcely perceptible; nothing could approach more nearly to a cure by immediate bony union. The movements of the knee, which were at first painful, soon became free and easy. The patient left the hospital on the thirty-fifth day, walking with facility.

Case V. J. C. Couet, a postillion, received a kick from a horse on the anterior part of the knee. The integuments were not divided, but tumefaction soon followed: notwithstanding this, being brought to the hospital the same day, I discovered a transverse fracture of the patella. By poultices, repose, and regimen, the inflammation was reduced in six days, and the fracture was dressed with the uniting bandage. Severe pain came on at first, but, as the bandage became loose, it gradually abated. On the twentieth day, when the bandage was re-applied, the interval that separated the fragments was scarcely perceptible. On the thirty-sixth day I discontinued the apparatus; the patient began to exercise the limb, the movements of the knee were gradually restored, and, in forty-nine days, he left the hospital, walking with ease.

Case VI. A man, by the name of Gesselin, aged twenty-seven years, of a strong constitution, walking very fast at night, struck against a post; he fell, and, on raising himself, his right knee became excessively painful, and he lost the

use of the leg. He dragged himself to a neighbouring house as well as he could, and was brought to the hospital Charité the next day. I perceived a transverse fracture of the patella, and the fragments were separated two fingers breadth. In ten days I reduced the inflammation, and then applied the uniting bandage. During the first twenty-four hours, the bandage excited severe pain; but it gradually subsided. The same circumstances occurred every time I renewed the bandage, which was on the ninth, sixteenth, and twentieth days. On the thirty-third day, which was forty-three days after the accident, I discontinued this apparatus, and merely applied a roller. The fracture had then united, but there remained, between the fragments, an interval of a finger's breadth, which did not deprive the patient of the use of his limb, or prevent him from walking.

CASE VII. A man, aged sixty-five years, having been rudely pushed in a quarrel, fell upon his right knee, and could not rise. The next day, the 16th of March, he was brought to the hospital; the knee was swollen and painful, and the flexion of the leg impossible. I covered it with an emollient poultice, and prescribed rest and low diet: however, on the 17th, in taking hold of the upper and lower parts of the patella, and pushing them laterally in different directions, I perceived a crepitation, which I was disposed to attribute to the rubbing of the patella against the condyles of the femur, but which excited some suspicions of a fracture, the pieces whereof were kept in contact by the aponeurotic fascia that covered them. On the 21st, the swelling and pain being dissipated, I made a very careful examination, which left no doubt of the existence of fracture. I moved the fragments laterally; but, as they were scarcely at all displaced, I merely directed the patient to be kept quiet, with the limb extended on an inclined plane, the most elevated part of which was next the heel. On the 9th of April the patient began to walk, and the limb was quickly restored to all its functions. But, on the 29th, I perceived that the uniting medium of the fragments had become somewhat elongated; no injury, however, followed; the elongation did not increase, and the patient left the hospital, perfectly cured.

After this chapter was printed, our respected colleague, M. Lallement, Professor to the Faculty of Medicine of Paris, communicated to us the following case, with the specimen represented in plate III. fig. 2; and plate IV. fig. 1.

In March, 1798, L. Maumillon, aged thirty-six years, a veteran soldier, of strong constitution, was thrown on a brick pavement by one of his comrades, with whom he was wrestling. He received the whole shock of the fall upon one of his knees, and immediately felt, in this part, a sense of tearing and crackling, with acute pain. He was unable to get up without help. M. Lallement saw the man a few minutes afterwards, and discovered a transverse fracture of the patella. There was a sensible interval between the fragments, which were easily brought together when the leg was extended. The fracture was reduced, and treated with the apparatus of Desault for two months, at the expiration of which time it appeared to have united. For a year the patient walked with a cane, and afterwards entered the service. The movements of the limb were perfectly free, except that flexion of the leg was slightly limited.

In August, 1810, the man died of apoplexy ; and M. Lallement having examined the knee where the fracture took place, found that the two fragments of the patella were firmly united, and could not be made to move on each other in the slightest degree. This bone was then boiled ten hours, and stripped of the articular cartilage and the tendinous and aponeurotic fibres that covered its surface. It was then evident that the affected patella was six lines longer than the opposite one ; that the fracture did not represent a straight transverse line, but the form of an *S* reversed : the superior fragment was more outward than the inferior, so that the axis of the first formed with that of the second, an angle of 130 degrees, with its sinus turned toward the external side of the knee. It is evident that, from this inclination, the external sides of the two fragments were put in contact ; that the internal part of the superior fragment was separated from the rest by a vertical fracture ; and that this portion, being displaced downwards, was also put in contact with the opposite point of the inferior fragment ; but this part being obliquely displaced, and in a parallel line to the inclined axis of the superior fragment, that portion of the principal fracture which belonged to it, could only be imperfectly joined to the inferior fragment : thus there remained a space that was filled with fibrous cellular tissue, which the boiling detached. It was evident that the re-union of the two extremities of the fracture was immediately formed by true callus; but, in the interval, were a series of bony eminences, having an oblique direction, and parallel to the inclined axis of the superior fragments, separated by oblong spaces parallel to the eminences. In that

PLATE IV.

Fig. 1. A posterior view of a patella fractured and united by bone. (See
    Plate III. Fig. 2.)
    a b. The ends of the transverse fracture.
    c d. The two principal portions of the bone, inclined towards the side *a*.
    e. Traces of another longitudinal fracture, crossing the first near the
        side *b*.
    f. The part corresponding to the greatest breadth of the callus, showing
        some evidences of its primitive fibrous texture.
    g. Part of the articular surface.
Fig. 2. A tumour occupying the lower extremity of the thigh, seen from
    the outer side, covered with soft parts.
    a. The situation of the patella.
    b. The ligament of the patella, sensible to the touch.
    c c c c c. Several tubercles in the surface of the tumour, capable of be-
        ing felt through the skin.
    d d. Other tumours forming.
    N. B. The limb is represented in the greatest degree of flexion of which
    was susceptible.
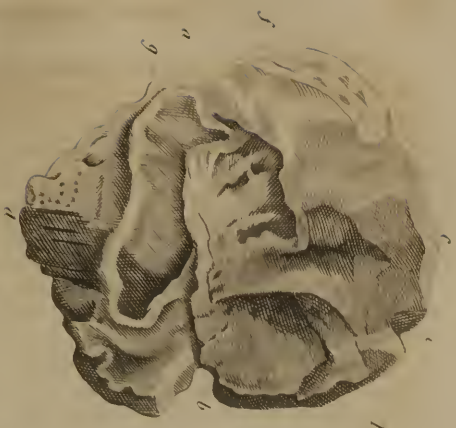
Fig. 1.

Fig. 2.

part the osseous tissue is more spongy and cellular than at the point of re-union. This middle space has the appearance of a cellular fibre consecutively ossified. Upon the anterior surface of the patella the bony re-union is more regular, although there is some slight appearance of striæ, which resembles the ligamentous substance that naturally covers this substance, converted into a solid compact mass. There is a narrow and deep groove opposite the defective part of the posterior re-union.

CHAPTER XV.

Of Fractures of the Bones of the Leg.

THERE appears, at first sight, a great analogy in the structure of the leg and forearm : two parallel bones, articulated together at their extremities—separated all the rest of their length by a space filled with ligamentous membrane—articulated at their superior part by an angular ginglymus in the thigh, and with the foot by the same kind of articulation—affording attachment by their surface, and by means of an intermediate ligamentous membrane, to a number of muscles destined to move the foot and toes : such is the structure of the tibia and fibula. But these two bones do not execute rotatory movement, and only one of them is articulated with the femur, and this alone transmits the weight of the body to the articulation of the foot, of which it forms the central part ; while the other, which seems to be of no other use in the five superior sixths of its length, than to afford insertion to the muscles, extends, on the outer side of the articulation of the foot, even beyond the level of the malleolus internus, and has no other office than that of preventing the foot from being turned too far outwards. These differences destroy all similarity between the causes, mechanism, signs, and treatment of fractures of the leg and those of the forearm.

The two bones of the leg may be fractured at the same time, or either of them separately. We shall treat of them under the head of *Fractures of the Leg, of the Tibia,* and *of the Fibula,* according as both, or either of these bones, may be affected.

ARTICLE I.

Of Fracture of the Leg.

Fracture of the leg is more common than that of either
of its bones alone. The fracture may be oblique or trans-
verse; the direction of the fracture is not only subject to
many variations, but both bones may be broken in several
points of their extent: the soft parts may, at the same time,
be contused, or even torn, by the splinters of the fracture,
or by the cause that has produced it.

There is no well authenticated case of fracture of the leg
produced by muscular action; it is always the result of vio-
lence, applied either directly or mediately. Thus a fall on
the feet often fractures the tibia, and generally about the
middle, where the bone is smallest: it is sometimes frac-
tured nearer the articulation of the knee. But, when the
tibia is fractured in the middle of the leg, the fibula is ge-
nerally fractured higher or lower, and sometimes even near
one of its extremities. A violent percussion on the leg,
when the foot is resting on the ground, may have this effect;
and although the blow be on the tibia, if it be so violent as
to effect a solution of continuity of this bone, and a displace-
ment of the fragments, the fibula will be subsequently frac-
tured. In this case, the last fracture will not be parallel to
the first. Finally, the weight of a heavy body on the leg,
when it is extended on the ground, such as the fall of a
stone, or the wheel of a carriage passing over it, may not
only fracture the two bones, but occasion contusion, and
tearing of the soft parts.

In fracture of the leg, displacement of the fragments may
take place in all directions; and this displacement is accord-
ing to the direction of the fracture and the cause that pro-
duced it. When the fracture is transverse, the displacement
can only take place in the direction of the thickness of the
fragments, particularly if it be in the superior part of the
tibia. When the fractured surfaces are large, the swelling
of the soft parts may increase the small tendency of the
fragments to become displaced. The fragments seldom pre-
serve their natural relations, even if they correspond by
large surfaces perpendicular to the length of the bone; the
smallest movement of the limb will destroy their contact,
and cause them to pass each other. When the fracture is
oblique, and caused by a fall on the feet, this last kind of

displacement is inevitable. Most frequently the superior
fragment presents a sharp point, directed downwards and in-
wards, and projecting under the integuments which cover the
internal surface of the tibia ; while the inferior fragment is
drawn backwards and downwards, by the muscles on the
posterior part of the leg. If the fall have not been very se-
vere, or from a great elevation, and especially if it have been
moderated by a slight extension of the foot, the displacement
may consist merely in a slight projection of the superior
fragment, which it is difficult to prevent. It is remarkable
that, notwithstanding the inclination of the surfaces by which
the fragments correspond, and the tendency to ulterior dis-
placement, which, it would seem, ought to follow, we do
not observe a shortening of the limb, as occurs in the thigh
in analogous cases, although the fractured fibula be inca-
pable of resistance, and rollers have little efficacy in these
instances. This observation, which, however, does not apply
to compound fractures of the tibia, is explained by the in-
sertion of most of the muscles along the whole length of the
two bones. But, when the fall which has produced the frac-
ture has been violent, it displaces the fragments at the same
time : in this case, while the ground arrests the foot and the
inferior fragment, the motion of the body pushes down the
superior fragment obliquely in the direction of the fracture.
Thus the latter distends, or perhaps penetrates, the soft
parts. In like cases, the upper fragment has been known to
bury itself in the ground.

It is almost impossible for both bones of the leg to be
broken without the limb being bent towards the posterior
part. This results from the action of the muscles, some of
which are attached to the posterior surface of the bone, and
reflected behind the lower extremity of the tibia ; and others
are attached low down, posteriorly between the two bones,
and form an angle with each other above. Both act in
drawing backwards the opposite extremities of the frag-
ments, while the last are supported by their corresponding
surfaces, because the muscles of the anterior part of the
interosseous space are parallel to the axis of the two bones,
and especially of the tibia.

Lastly, the displacement of the fragments is the more
easy, as the point of the foot is naturally directed outward,
and the greatest part of its size and weight is beyond the
central line of the limb. This kind of displacement may be
favoured by the oblique direction of the fracture. These
causes are, however, never sufficient to carry the displace-
ment to the extreme degree in which it occurs, in conse-

quence of inconsiderate movement, or by the weight of the bedclothes. The same may be said of displacement in which the point of the foot has been turned inwards, unless the fracture of the tibia be very oblique, and in a direction opposite to that in which it almost uniformly happens, which we have never yet seen.

Nothing is more easy than to discover a fracture of the two bones of the leg: their superficial situation, and their great tendency to become displaced, render the deformity and crepitation very evident.

This fracture is much less serious than those of the thigh, because the limb is smaller and the displacement not so extensive, and may, moreover, be kept more perfectly motionless. When a fracture is near the ankle, the ligaments become affected with chronic inflammation; whence a stiffness and difficulty of motion remain some time after the bones are united. As to the danger which accompanies compound fractures of the leg, we have already said enough under the head of Fractures in general.

Reduction of a simple fracture of the leg is generally easy; extension indeed is hardly necessary; for, as we have already observed, the bones seldom ride upon each other: it is only necessary to place the limb and point of the foot in their natural situation. But, if the fracture be oblique, and the bones ride upon each other, extension remedies the displacement only for a moment.

From what we have just observed, it will be seen that the treatment of fracture of the leg is very simple; the tendency to lateral, longitudinal, or spiral displacement, is very easily counteracted by lateral compression; the preservation of the interosseous space is not an object of the greatest importance; but particular attention is required as to the state of the fibula. Of this we shall speak more particularly in the article on fractures of that bone.

Fracture of the leg is to be kept in place by a bandage of strips, wooden splints, bags of chaff, and ribbons. The patient being undressed, and placed upon a suitable bed, the limb is to be supported by two assistants, one of whom takes hold of it below the patella, and the other at the foot. The limb being thus raised, the surgeon is to arrange, underneath, the parts of the apparatus in the following order:— 1st. The pillow of chaff, as long as the leg, and almost square, covered with a napkin. 2d. A piece of linen or splint bandage, as long as the pillow, and wider; below which are to be placed three ribbons, and above it the strips, of a number sufficient to cover the whole leg. The

pillow must be perfectly horizontal, and shaped exactly to
the posterior surface of the leg, so that every part may
equally support the weight of the limb. The limb is now
to be cautiously placed on the apparatus, and reduced. We
know that the reduction is exact, when the great toe, the
internal side of the patella, and anterior superior spinous
process of the ilium, are brought in a line, and the limb is
restored to its natural length. The bandages are then to be
wet with a resolvent liquid; two square compresses are to
be laid upon the anterior and lateral parts of the leg, and
the bandages are to be applied in the order of their situa-
tion. In each side of the splint-bandage is to be rolled a
splint, which should extend from above the knee to below
the sole of the foot, and the spaces between the limb and
each splint are to be very carefully filled with chaff, con-
tained in bags that extend the whole length of the limb. A
third bag is to cover the leg, from the knee to the ankle, on
its anterior part, and over this a splint is to be applied of
the same length: the ribbons are then to be tightened, and
tied over the superior splint. If, after the application of the
apparatus, the foot be strongly inclined in the direction of
the extension, it may be supported by a bandage, passing
under the sole, and fastened to the splints on each side.

If the pillow on which the limb reposes be not properly
adjusted, the heel, by supporting a disproportionate pres-
sure, may inflame and mortify, leaving the tendon of Achil-
les and the os calcis denuded, and affected with necrosis.

In very young patients, the roller and pasteboard splints
are preferable. We should be careful to tighten the band-
age as often as it becomes loosened, to change it entirely
every eight days, and to keep it constantly wet with a resol-
vent liquid. From the forty-fifth or fiftieth day we may use
the roller, and soon afterwards we may allow the patient to
walk with crutches. It is to be remarked, however, that
the period of union is protracted in old patients, and in
those in whom the bones have been obliquely fractured.
They do not acquire sufficient strength to support the body
before sixty days; and if the patient walk too soon, the leg
will become bent backward.

It has been proposed to employ continued extension in
complicated fractures of the leg: it is much more important
to attend to the means of preventing inflammation and its
consequences. However, in certain cases of this nature, ex-
tension has been employed with success: we have ourselves
derived great advantage from it, in some cases of fracture

of the leg, with shortening, which had not united in the or-
dinary period. Nevertheless, we are persuaded that, in
most cases of fracture of the leg, the bones may be kept
sufficiently motionless by the ordinary method.

ARTICLE II.

Of Fracture of the Tibia.

When we compare the size of the tibia with that of the
fibula, and consider the solidity of the union of these bones
with each other, we are disposed to believe, at first sight,
that the fibula can hardly escape when the tibia is broken ;
but experience shows the contrary ; in fact, the tibia alone
supports almost all the weight of the body, which it receives
from the femur, and transmits to the astragalus ; moreover,
being placed on the anterior part of the leg, and thinly co-
vered with skin, it is more exposed than the fibula to the
direct action of causes capable of fracturing it ; and, lastly,
the fibula, being thin and flexible, yields to violence without
breaking.

The tibia may be fractured in any part of its length : it
is almost always broken transversely. Falls and blows
which fracture it, sometimes act upon the extremities of the
bone, sometimes at the place where the fracture occurs.

The fragments very rarely become displaced ; the fibula
acts like a splint, to steady the broken portions : they can
only become displaced in a very trifling degree. We have,
however, seen a fracture of the tibia very high up, caused
by the kick of a horse, in which there was a marked dis-
placement, in the direction of the bone, that could not be
remedied ; so that the tibia remained hollowed anteriorly.

The very slight displacement of fracture of the tibia ren-
ders the diagnosis very difficult ; and the case is still more
obscure, if the patient have been able to walk after the frac-
ture, as has happened in many cases. We may suspect the
existence of this fracture, if, after a fall or a blow, pain be
felt in any part of the tibia, that is increased by placing the
foot on the ground, or attempting to walk, and continuing
beyond the ordinary period of pain produced by simple con-
tusion ; if a slight edema appear over some part of the bone,
and if the patient twitch his limb during sleep. We may
be sure that there is a fracture, if we feel any inequalities

along the edge of the tibia, by the motion of the fragments, and sometimes even by crepitation—obscure indeed, but such as will not escape an experienced surgeon.

In general, fracture of the tibia is a very trifling accident; it might perhaps be cured without the aid of art, if the patient would keep himself quiet in bed during the proper period.

When the fragments of the fracture are displaced laterally, they can be readily adjusted : the surgeon should push them in opposite directions, while two assistants make extension and counter-extension. When the displacement takes place in the direction of the thickness of the bone, it is easily remedied.

In order to keep a fracture of the tibia reduced, we may employ indifferently the bandage of strips, long splints, and bags of chaff; or a roller, with splints of wet pasteboard or thin wood. This last method is preferable, particularly for children.

When fracture of the tibia is complicated with contusion or inflammation, we are to apply emollient and anodyne poultices before we adjust the apparatus.

The fracture unites in about forty days; and as the joints of the knee and foot do not become very stiff or much swollen, the limb is quickly restored to its functions.

ARTICLE III.

Of Fracture of the Fibula.

It is easy to conceive how the direct application of violence may fracture any part of the fibula, but it is not so easy to understand how a force which acts on the foot alone, may produce this effect. The mechanism of this process has escaped almost every author, except Pott and Fabre. The fibula supports no part of the weight of the body; but, at its lower part, it limits the lateral movements of the foot outwards. Now, if any violent cause, such as a perpendicular fall, draw the foot in a state of adduction or abduction, the astragalus, in the first case, presses, from the limb outwards, the inferior end of the fibula; and, in the second case, it presses the fibula from below upwards, with a force equal to the momentum of the body. In both instances, the violence is transmitted, on the one hand, to the ligaments which unite the lower extremities of the tibia and fibula.

and which would be broken, if they were not uncommonly
strong ; and, on the other hand, to the superior articulation
of the tibia ; so that the natural curve of the fibula must be
augmented, and thus it breaks in that part of its length
which offers least resistance.

The most important varieties of this fracture arise from
its situation more or less distant from the inferior end of the
bone. When the fracture arises from an immediate cause,
it corresponds to the part where the violence has acted ; but,
when it takes place according to the mechanism we have
just explained, its situation is extremely variable.

The moment the fibula is broken, the fragments are drawn
towards the tibia, by the action of the muscles on the ante-
rior surface, and the deepest of the posterior muscles of the
leg, as well as by the tension which these muscles commu-
nicate to the fascia of the leg. No longitudinal displacement
can occur ; the inferior fragment cannot be carried inwards,
without the external ankle being dragged outwards. Now,
the distance which separates the two malleoli being in pro-
portion to the transverse diameter of the articular surface of
the astragalus, which they embrace, this space cannot be in-
creased, without destroying the natural relations of the ar-
ticular surfaces ; and as this change is effected by the sepa-
ration of the external ankle, it follows, that the foot, being
no longer supported outwardly, must incline habitually to
that side. This inclination of the foot is increased if the
patient walk ; the sole of the foot is then turned outwards,
the weight of the body being supported by its internal edge.

The evidences of this fracture are derived from an atten-
tive examination of the conformation of the bone : this exa-
mination is not difficult, so far as regards the two lower
thirds, provided no considerable tumefaction have arisen.
The upper third of the bone is covered by a greater thickness
of soft parts, and the slight deformity of a fracture is scarce-
ly to be perceived. It is to be remarked, however, that, in
this latter case, the fragments are capable of being more
extensively moved ; and that, moreover, a mistake as to the
nature of the case, is not so serious as in the other instance.
Considerable tumefaction may prevent a discovery of frac-
ture of the fibula, even when low down ; but, when we
suspect it, we should be extremely careful not to be de-
ceived after the swelling is dissipated. In many cases where
the diagnosis is obscure, we may be almost certain of a
fracture, from the circumstances which attended the acci-
dent. One of the most common of these, is a violent incli-
nation of the foot to one side, which tends also to produce

sprain or luxation of the foot: therefore fracture of the fibula is often complicated with this last accident. If, at the same time, (the fracture being very low down, and not discovered or reduced) it happen that the external ankle be strongly inclined outwards, the foot has a tendency to be luxated anew; the articular pulley of the astragalus is pushed under one of the malleoli, commonly the internal; the integuments are violently distended, and soon inflame or ulcerate, and even mortify: thus air enters the joint and destroys the patient, or renders it necessary to amputate his leg. The circumstance of a sprain, or luxation of the foot, especially inwards, is a strong presumption of the existence of fracture of the fibula; and the case admits of little doubt, when, after the reduction, the foot is so moveable that the exact relations of the articular surfaces do not continue, and there is a constant tendency to repeated luxation.

Simple fracture of the fibula is a very trifling accident; all we can do towards placing the bones in apposition, is to depress the external ankle, and bring it to its natural distance from the internal. The most important part of the reduction, and indeed all that is essential, is to restore the ankle to its natural situation.

This fracture is very easily kept reduced by the bandage of strips, and two splints, one of which extends beyond the external edge of the foot, and presses it strongly inwards, while the other reaches only to the internal ankle.

After forty days we may use a roller, and permit the patient to walk with crutches. When the fracture is high up, the foot contracts very little stiffness, and the patient soon walks as well as ever. But, when the fracture is near the lower extremity of the bone, the ligaments and other soft parts inflame and swell, and the joint becomes stiff, and remains so for a long time.

CHAPTER XVI.

Of Fractures of the Bones of the Foot.

THE small extent of the bones which form the foot, their shape, the strength of their connexions, and their spongy structure, render their fractures very rare and difficult; in fact, they can only arise from direct violence; and, in these cases, the bones are generally comminuted. What we have said of fractures of the bones of the hand, applies equally to those of the foot, excepting that of the os calcis, which, by reason of its length and its connexion with the strong muscles that extend the foot, is exposed to solutions of continuity, of which we shall treat particularly.

This bone, placed almost horizontally below the point of the articulation of the leg with the foot—extending beyond the joint, to receive the tendo Achillis, which is inserted into it at a right angle—bearing directly the action of the extensor muscles of the foot, being balanced between their contraction, the weight of the body, and the resistance of the ground, and thus forming a lever of the second kind, unites the conditions most favourable to the production of fracture by muscular action. Fractures of the os calcis, therefore, arise most frequently from this cause; and it is probable they would be still more common, were it not for the flatness of the bone behind, by which it is made capable of resisting very great violence in a vertical direction; if the tendo Achillis did not frequently break; and if, above all, the leg and thigh did not bend at the moment of a fall on the point of the feet. It is, in fact, remarkable, that this fracture takes place in circumstances where a fall on the feet was not followed by flexion of the inferior extremities. This is exemplified in a case of a woman of the hospital of Salpétrière, who, by means of a rope that was found too short, jumped out of a window, and stretched out her legs to reach the ground, and render her fall less dangerous.

The cases of this rare fracture offer very little variety, and it would be surprizing that the swelling of the soft parts should render it difficult to distinguish the interval between the fragments, if we did not consider that the muscles, aponeuroses, and ligaments that surround the os calcis, and which are not broken by the cause that has produced the fracture, permit only a very moderate displacement.

Fracture of the os calcis (unless it be produced by a gun-shot wound, or some similar cause) takes place always in that part of the bone which is comprized between its articulation with the astragalus and its posterior extremity. It is always caused by a fall on the point of the foot, in which this part is caught in a state of violent extension. Some facts, however, would lead us to believe that a violent effort, without a fall, may produce the same effect.

The immediate consequence of the solution of continuity, is the displacement of the part of the posterior fragment which the extensor muscles of the foot draw upward; but the anterior part being held by the resistance of the soft parts that cover the inferior surface of the bone, the displacement is always moderate; and, in some cases, the continuance of pain after the swelling subsides, alone leads to the suspicion of fracture.

A fall on the point of the foot; inability to rise or walk; a sharp pain in the heel; a sensible depression of this part, higher up than in the natural state; a projection lower down, and towards the sole of the foot; the possibility of bringing the heel in its natural situation, and then giving it lateral movements while the foot is extended, and sometimes the lateral mobility of the fragments alone—are the signs which characterize this fracture. It is doubtful if crepitation have ever been perceived.

It is not yet known if the fragments of this fracture become united by callus when they have been sensibly displaced: however doubtful this may be, persons who have been cured of it, have used their limbs as well as ever.

It is undoubtedly easy to reduce the fragments of this fracture; there are indeed cases in which no reduction is necessary, and where, by rest alone, a cure, exempt from deformity, may be obtained. When the foot is extended, and the leg slightly flexed, the smallest force is sufficient to replace the posterior fragment in its natural situation, and to effect an exact coaptation. But what has been said of fracture of the patella, of the olecranon, and neck of the femur, is also applicable to that of the os calcis—there is no means of resisting the tonic action of the muscles; and fracture of the os calcis, besides this difficulty, has some which are peculiar to itself. On the one hand, extension of the foot is a constrained position; the flexor muscles, being strongly stretched, contract with great force: on the other hand, the power that is employed to push down the posterior fragment, must inevitably act upon the neighbouring parts, and

especially upon the tendo Achillis, which is thus bent and
shortened.

It has been proposed to employ the slipper which J. L.
Petit invented for the rupture of the tendo Achillis; but it
is evident that this ingenious contrivance can answer no
good purpose in fracture of the os calcis.

It is pretended that the following bandage has been used
with advantage. An oblong compress is confined on the sole
of the foot and posterior part of the leg and thigh, by means
of a roller; and, in order to keep the foot extended, and the
leg bent in a still greater degree, the two ends of the ob-
long compress are turned back several times in an opposite
direction, under the first and last turns of the bandage; at
the same time another thick compress is placed transversely
above the posterior fragment, and a bandage passed over it
in the form of a figure of 8; and, lastly, to this bandage
some have added a splint, applied to the anterior part of the
leg and the back of the foot.

It is evident that we can effect nothing by this treatment,
except extension of the foot, flexion of the leg, and com-
pression of the muscles of the calf; but it will not exercise
any particular and constant action on the posterior fragment
of the fracture, or even keep the fragments fixed below in
their natural situation. Nevertheless, if, as is asserted,
these, and other analogous means, have been employed with
success, we must conclude that this fracture may be cured
without keeping the bones in their natural situation, and
that it is sufficient to remove or diminish the tension of the
soft parts, so as to prevent the too great separation of the
fragments and the pain that would result; and, consequently,
that the essential indications are sometimes merely to keep
the limb at rest, and, in other cases, to preserve a particular
position, and to compress the muscles of the calf. If the
extension of the foot were a less constrained attitude, it is
probable that fracture of the os calcis would be perfectly
cured by rest alone. We think that, where it is necessary
to apply any apparatus, a splint, slightly curved, placed on
the anterior part of the leg and on the back of the foot, co-
vered with a bag of chaff, and kept on by two bandages, one
of which embraces the foot and lower end of the splint, and
the other the superior extremity of the splint and the upper
part of the leg alone, without in any manner compressing
the tendo Achillis, would answer the purpose extremely
well. This apparatus is in imitation of the second, which
Monro employed upon himself, when he broke the tendo

Achillis; and however defective it may be, it promises more
than any that has been offered.

Fracture of the os calcis unites in forty or fifty days;
however, patients should not walk until some time after-
wards, and then with crutches, until the fracture has ac-
quired perfect solidity. A slight degree of swelling and a
little stiffness remain, which time and exercise dissipate.

CHAPTER XVII.

Of the Denudation of the Bones.

VIOLENCE exercised upon the soft parts which cover a
bone, may separate the periosteum. If this effect be
produced by a sharp body, moving with little force and more
or less parallel to the bone, its action may be confined to the
soft parts, which, in this case, are torn exactly in the point
of their continuity with the bone. Thus the greatest part of
the cranium has been completely stripped of its covering,
without the slightest violence to the bone itself. But, when
the force is great, the body obtuse, and acting in a direction
more or less perpendicular to the surface of the bone, the
soft parts are torn and contused, and the bone itself is more
or less injured; the superficial lamina may be depressed,
and the whole part which suffers this violence may become
completely mortified. It would seem, in fact, that a violent
shock or commotion of the bony tables is sufficient to deaden
them, since we see exfoliation result from certain wounds
with denudation of a bone, in which not the slightest depres-
sion, or other alteration of their form, has been perceptible.

Inflammation of the periosteum, when it terminates by
suppuration, denudes the bone, and sometimes even brings
on mortification of its outer laminæ. This is a natural con-
clusion from certain facts of this kind, in which a very su-
perficial exfoliation has been observed, and where there is
no reason to suppose that any violence had been offered.
These cases are very different from those in which, in con-
sequence of an abscess more or less extensive, and attended
with serious symptoms, a portion is separated throughout
the whole thickness, and sometimes even of the whole cir-
cumference of a cylindrical bone. Mortification of so great
an extent cannot result from a simple affection of the peri-

osteum; the separation of this membrane, in such cases, is a remote consequence of a specific cause, which has destroyed the life of the bone. Neither does a phlegmon endanger the existence of an adjacent bone, unless the periosteum be directly affected. Our observations on this subject do not, therefore, apply to those cases in which this membrane is primarily affected.

So true it is that the bones possess all the vital properties of other organs, that mortification of their superficial laminæ is produced by their being exposed to the action of air, irritating applications, or pressure. Thus a simple denudation, improperly treated, may cause an exfoliation. Contusion, without external wound, if it cause a sensible depression, will have the same effect.

When denudation has been produced by an external cause, and the accident is simple, and unaccompanied by depression of the denuded bone, the parts are immediately reunited, if they be directly brought together, without giving time to the air, or any irritating body, to excite inflammation in the soft parts, and to produce mortification of the superficial laminæ. We have every reason to believe that the process of nature, in this case, is the same as that by which the immediate re-union of the soft parts is accomplished.

The impossibility of distinguishing, with accuracy, the cases when a re-union would be useful, and when it would be ineffectual; the great advantages resulting from a rapid cure obtained by immediate re-union, and the little inconvenience of an unsuccessful attempt to procure it, establish a general rule, to replace the soft parts on a denuded bone always when there are no signs of organic alteration. We shall not enlarge on the precautions proper to assure success in this method, as we have treated of them in the article on Simple Wounds; we shall only observe, that vital action is less in the bones than in the soft parts; all the functions are executed in a slower manner. This want of harmony in parts that are put in contact, occasions the re-union to proceed slowly; therefore, the means employed to keep the parts together, ought not be of an irritating nature, and they should be capable of acting for a longer space of time.

When the parts have not been brought together, the following is the process of nature in effecting a cure:—The soft parts inflame and suppurate; their sinking, by thinning the edges of the wound, fixes them to the circumference of the denuded bony surface; this last, sometimes in all its

parts, sometimes in a space of more or less extent along the flesh, assumes a light rose colour, which becomes deeper, and extends, by degrees, to all the rest of the denuded sur- face ; granulations soon appear, sometimes scattered on se- veral parts of the denuded bone, sometimes only towards the edges of the wound, from which they proceed to the circumference, and finally cover the whole bony substance, becoming confounded with those which arise from the edges of the wound. These become thin, and covered with a pel- licle, which dries, and leaves a cicatrix over the whole gra- nular surface.

This process has been called *insensible exfoliation*, and it was believed that the laminæ of bone which were succes- sively detached, were dissolved in the pus ; but the term *insensible exfoliation* is vague, and the idea which it is meant to convey is incorrect. When the periosteum is stripped from a bone, and nature is left to effect a cure, the cicatrix becomes adherent to it ; if the bone then be macerated, so as to remove all the soft parts, we find it rough, unpolished, and covered with spiculæ. When an exfoliation takes place in one part of a denuded bony surface, the rest being co- vered immediately with granulations, we find, afterwards, a depression over the spot in which the exfoliation took place. These facts are far from proving the separation of any la- mina of bone : the phenomena resemble those which accom- pany other affections of the bony tissue, in which there can- not be any separation or loss of substance. Is it not probable that the inequalities are the result of inflammation and tur- gescence of the osseous tissue during the healing process ? This opinion is confirmed by the fact, that, if we examine the bone at the expiration of some months, we no longer find it rough and unpolished, but of a natural appearance. Must we, to explain this phenomenon, suppose a new exfo- liation to take place ?

When a portion of bone mortifies, it becomes detached from the living parts ; and this process is termed *exfolia- tion*. How it is effected we know not ; but the following are the phenomena which accompany it :—The edges of the wound, as in the former case, inflame, swell, suppurate, drain, sink, and cicatrize ; the dead bone loses its redness, becomes dry and brown, and its edges thin and pliable : granulations shoot through the bone where it is thin, and gradually detach it ; the space left by the separation of the dead bone is covered with firm red granulations, adhering to the parts below, and continuous with those which are issuing from the edges of the wound. All that is known of

the mechanism of this process is, that the granulations, which are left bare by the separation of the bone, are formed of the vascular tissue of the bone rendered turgid by inflammation, and containing vessels which carry red blood.

Until the middle of the eighteenth century, physicians, misled by false hypotheses, were in the habit of using a great variety of applications to promote exfoliation: such treatment did infinite injury. We are indebted to M. Tenon, one of the most respectable members of the ancient Academy of Surgery, for a series of simple experiments, from which it results, that the contact of air, the application of spirituous substances, or even of cold water, alike retard the process of exfoliation; that caustics produce a necrosis, which is long in getting well; and that warm water, fatty substances, and especially poultices, promote the growth of the granulations, and, consequently, the separation of the dead bone. To borrow the words of this ingenious experimenter, " every thing which acts upon the bone must be studiously avoided."

Belloste having observed that a denuded bone never got well until it was covered with granulations, and that these granulations appeared to arise from the deep-seated parts of the bone, thought he could prevent exfoliation, and abridge the work of nature, by perforating the bone in several parts of its surface. The granulations did, in fact, appear from the openings which he made; and, during this time, nature having finished her work on the rest of the denuded surface, he was firmly convinced of the efficacy of his treatment; and his practice has numerous advocates. But it is easy to conceive, that, when exfoliation ought not to take place, this process is useless; and, when exfoliation is necessary, it is of little consequence whether the dead portion be affected or not. It is even demonstrated, in this case, that the granulations, which arise from the openings, and adhere to those which the lamen covers, and which are less bare after its separation, may, by swelling on the top, act like broad-headed nails, and retain the dead bone after it is otherwise completely detached. M. Tenon, who also tried this plan, found it necessary to break the separated lamina of bone, in order to remove it. Nothing proves more completely the inutility of this practice, than the praise it received. Some have recommended it, because it hastened exfoliation; and others, because it prevented exfoliation. Monro justly remarks, that Belloste derived, from repeating his dressings at distant intervals, those advantages which he attributed to his perforations.

From all that has been said relative to the simple denudation of the bones, where their immediate re-union is impracticable, it results that emollient poultices are alone admissible, and that every surgical operation is injurious, except in some rare cases, where the granulations enclose a portion of bone otherwise detached. In this case, a small incision across the circumference of the granulations, removes the difficulty.

CHAPTER XVIII.

Of Wounds of the Bones.

WOUNDS of the bones differ from each other in many respects. The instruments which produce them, vary in size, sharpness, and velocity: they may act obliquely or perpendicularly; may penetrate partly or wholly through the bone, or only a part of it, and fracture the rest.

Wounds of the bones are generally very easily discovered; but, when the wounding instrument has acted very obliquely, the wound of the soft parts not being parallel to that of the bone, the latter is not perceived, especially if a thin portion of bone be entirely separated from the rest, and remain connected only to the soft parts.

These wounds may generally be re-united, if the divided parts can be kept from the contact of air. It is true, the time necessary for the cure is longer than that which nature employs in the consolidation of fractures; but we do not see that exfoliation takes place, which many circumstances would seem to render almost inevitable. The time necessary for a cure is shortened, when the parts have been immediately brought together; if that have not been done, we must wait the formation of granulations, sometimes even the tedious process of exfoliation: it may also happen, if the parts have not been put immediately into contact, and kept perfectly still, that the fragments of a bone which has been completely divided do not re-unite, and that a preternatural joint is formed. This accident is the more to be apprehended, because re-union takes place more slowly than in fractures.

The most serious cases of wounds of the bones, are those in which not only the bone or bones, but the principal ves-

sels and nerves of the limb have been divided. In cases
where this last circumstance does not obtain, we may al-
ways hope for a re-union of the divided parts, especially in
those limbs where there is but one bone. Wounds near an
articulation are always serious, but particularly so, if they
communicate with a large joint. Wounds made with a sharp
instrument are less serious than others.

From what has been said, we may see the propriety of
the general rule, to place the divided parts in apposition, in
almost every instance ; if they do not unite, no injury re-
sults from the trial, while the most serious consequences
may ensue from neglect of this precept.

The only exceptions to this rule are, in perpendicular
wounds, where the instrument has not penetrated deep ; and
in very oblique wounds, in which a very small piece of bone
has been separated, and remains attached to the soft parts,
leaving little hope of the possibility of its re-union ; and,
even in this case, which is extremely rare, an exact apposi-
tion of the soft parts, after the removal of the separated
piece of bone, is a matter of the greatest importance.

When the separated portion of bone is removed to a dis-
tance from its natural situation, we should very carefully
replace it ; when there are several small irregular splinters,
they should be removed, by cutting, with a bistouri, their
attachment to the soft parts, before we proceed to replace
the rest.

In all cases of oblique wounds, we are not to forget that
an exact coaptation of the divided bones is impossible, on
account of the deformity they experience ; that the intervals
and small spaces will be filled up by the soft parts ; and
that the bones will unite much more slowly than the lips of
the wound. Hence it is necessary to make a gentle, light,
but constant compression, on a wound in which a bone has
been affected ; and the most perfect rest must be main-
tained, even after the re-union of the external wound.

The means of effecting this object are precisely similar
to those employed in fractures ; it is even necessary to be
more attentive to keep the parts in a state of perfect rest.
We cannot, however, at first, tighten the bandages so as to
effect this object with great exactness ; but, when the in-
flammation has subsided, we are to use the utmost care in
keeping the parts in perfect apposition. Lamotte says, he
could have completed the cure of two fractures in the time
which he was obliged to wait before he could re-unite a
complete division of a bone. As to section of the soft parts,
we shall not add any thing to what has been said elsewhere

on that subject, except that, in some circumstances, it is impossible to conform to the general rules for the treatment of wounds. Thus, for instance, where the two bones of the forearm, the muscles on the back of the limb, and a part of those which correspond to the palmar side, have been divided, we cannot give the hand a position alike favourable to the antagonist muscles.

If any thing can prevent the fatal effects which follow the wound of a bone that communicates with a large joint, it is, without doubt, the immediate apposition of the parts; and we cannot insist too strongly on the necessity of effecting this with the utmost exactness.

If, from improper treatment, or other circumstances, the parts have not united, and suppuration have taken place, even then we should carefully place the parts in contact, and keep them in a state of the most perfect rest.

Lafaye, in one of his interesting notes to the Operative Surgery of Dionis, relates, that a man was brought to M. de Lapeyronie, who had received the stroke of a hatchet on his arm. The bone and most of the muscles were cut; the forearm and hand were cold and livid, and remained attached only by a strip of soft parts corresponding to the internal surface of the wound, and in which the large vessels were comprised. It was proposed to finish the amputation of the limb; but Lapeyronie, recollecting some examples of re-union in cases apparently desperate, resolved to try to save the limb. He brought the parts together, and left an opening in the dressings, in order conveniently to reach the wound. On the next day, the arm was swollen above the wound, and the pulsation of the radial artery was no longer perceptible. On the third day, there was a little heat and swelling in the hand and forearm, which went on increasing to the eighth day: the wound then appeared to have received new vigour. On the fourteenth day it began to re-unite; the eighteenth day, the cicatrix was far advanced, the limb was restored to its natural size, and the pulsations of the radial artery were sensible. A roller was substituted for the first apparatus, which was renewed every ten days. On the fiftieth day, the roller was discontinued; and, at the end of two months, only a slight numbness remained.

The four following cases are extracted from Lamotte's Traité de Chirurgie, tom. ii. obs. cccLxxxiii–iv–v–vi.

A man received a wound by an axe, which cut the tibia through its middle and inferior part, and interested the fibula. To prevent the return of hemorrhage, which had been copious, Lamotte stuffed the wound with dry lint, and

applied an apparatus, such as is used in compound fractures. On the third day, he moistened with brandy the dressing with which he covered the ends of the bones and the wound. *The same dressing was continued for more than ten weeks:* at the end of this time, the splints were discontinued. The patient could scarcely walk with crutches more than six months afterwards, and the limb continued edematous for a very long time.

A man, going out of a house, and placing his foot on a log of wood which a servant was employed in splitting, received so violent a blow from the axe, that the instrument penetrated his shoe and foot, and stuck firmly in the wood. The foot, almost entirely divided, remained attached only by the last bone of the metatarsus. It bled very freely, but the hemorrhage had ceased when Lamotte arrived. He brought the parts together, and kept them in contact by pieces of felt above and below, surrounded by compresses, and covered with a roller. On the fourth day, every thing was going on well. The dressings were changed every eighth day, until the fortieth: the pieces of felt were then omitted. The patient rose—his wound was healed. Fomentations of wine were employed; but Lamotte prevented him from walking for two months, doubting the firmness of the re-union. The cure was complete, and the limb recovered all its strength.

A man, in a quarrel, received a sabre-cut, which completely divided the lower part of the cubitus, and made a slight impression upon the radius. A dossil of lint, wet with brandy, was applied to the ends of the bone, and the rest of the wound was stuffed with lint, in order to prevent hemorrhage, which was apprehended, and which had been profuse. A roller was applied, and over it a piece of strong pasteboard, confined by a second bandage. The hand was kept in a state of semi-flexion, and the subsequent dressings were wet with brandy throughout the whole extent of the wound. The patient got well, " but," Lamotte observes, " not until twice the time necessary for the cure of a fracture."

In a single combat, a grenadier received a sabre-cut in the arm. " The instrument cut about two-thirds [of the thickness] of the humerus, near the elbow; the rest of the bone was splintered, like a piece of wood that has been partly split." No bad symptoms occurred. Lamotte applied the apparatus for compound fractures, and dressed the wound only once in four or five days. The re-union was complete in three months.

CHAPTER XIX.

Of Necrosis.

NECROSIS has been distinguished by different names, and, of late years particularly, the term *dry caries* has been applied indiscriminately to necrosis, and the disease to which the word *caries* is properly applied. According to the etymology of *necrosis*, it signifies a mortification of a greater or less extent of a bone. The celebrated Louis is the first who employed this term in a sense nearly similar to that in which it is now used: he limited its application to mortification of the whole thickness and circumference of a bone— an acceptation which, as we shall presently see, is not correct.

Every bone, and all their parts, are subject to this disease; but necrosis affects most frequently the more compact parts of the osseous structure, such as the flat bones, and the middle of those that are cylindrical. The tibia, the humerus, the femur, and the lower jaw, are the most frequent seats of this disease.

Experience has not shown that age, sex, or particularity of constitution, predispose to a necrosis.

In the flat bones, this disease may extend along one of the tables only. When any of the bones of the cranium are affected, the disease is usually confined to the outer table. It has been known to affect the whole surface of the skull. In some rare cases, the diploe of flat bones is diseased. Veidman saw a case of this kind in the os innominatum.

In the long bones, necrosis is constantly confined to the diaphysis, or body, unless it be produced by an external cause; but it may affect a circumscribed space of the external surface, or that which corresponds to the medullary cavity. It sometimes extends even to the articular extremities.

When the mortified part separates, it discovers asperities and inequalities, which arise from the unequal depth of the disease in different parts.

The causes of necrosis are external and internal. Almost all morbid poisons, but especially the venereal and scrofulous, may give rise to this disease. The psoric, rheumatic, and arthritic virus, may also produce it. Necrosis has likewise followed the suppression of the menses, and habitual or periodical hemorrhage. Are we to believe that the disease

is the effect of the suppression of these evacuations, or a collateral effect of the same cause?

The action of a freezing temperature congealing the surrounding soft parts; that of concentrated calorie, even below the degree necessary for burning; exposure to the air; the application of spirituous liquors, mineral acids, alkaline substances, and caustic salts; contusion; constant pressure; comminutive fractures, especially those produced by gunshot wounds—all these are causes of necrosis. They act with much greater effect in producing necrosis in the compact portion of the bones, than in their spongy structure.

The same internal causes which are apt to produce necrosis of the compact structure, often give rise to caries in the reticulated texture. Does this arise altogether from the difference of structure?

The denudation of a bone, and the accidental separation of the periosteum, being sometimes followed with a mortification of the denuded portion, it has been unjustly concluded that the death of a bone depends exclusively on the separation or disease of this membrane. The periosteum and medullary membrane undoubtedly perform a very important part in the nutrition of the bones; but the innumerable inosculations of the vessels are sufficient to continue the circulation of the fluids, and nourishment of the parts, without sensible injury from the simple slipping off of the periosteum. It cannot be doubted, that the causes which produce necrosis act directly upon the tissue of a bone: this becomes deadened to a greater or less extent, and the adjacent parts are successively affected with inflammation. Thus far necrosis differs in no respect from mortification of the soft parts.

We shall consider, first, the cases in which the periosteum is diseased at the time of the necrosis; and, secondly, that in which this membrane continues healthy.

In the first instance, the disease commences with pain more or less acute, and which varies according to the nature of the disease which has produced this affection of the bone. Thus, for instance, it is worst at night, when the malady is venereal, and sometimes also when it is gouty or rheumatic. It is confined principally to a point in the surface of the bone; and a flat tumour soon forms, at first not circumscribed, doughy, soft, without inflammation of the skin, and more or less distinct, according to the thickness of the soft parts over it. After a short time, the skin becomes red; a phlegmon is formed; but the fluctuation remains obscure to the last. However, the skin grows thin, and ulcerates; one or more openings form, which soon

unite, and give issue to pus, and an eschar, formed of the periosteum and the cellular tissue, afterwards the pain almost ceases, the edges of the ulcer continue loose and vacillating, and the wound is imperfectly drained ; the granulations become pale and bloated ; the opening contracts, and remains fistulous ; the bone continues denuded ; at first it is pale, then it grows black, and the surface becomes ragged : things remain in this state a longer or shorter time, according to the greater or less thickness of the diseased portion of bone. After a length of time, the denuded part of the bone appears elevated, and, if struck with a probe, it emits a duller sound than healthy bone ; it is painful when pressed, which was not the case before ; it becomes moveable, and sometimes drops of blood exude, apparently from the granulations around the circumference of the moveable portion. Some time afterwards it becomes completely detached, and the part below it is thickly covered with firm red granulations, continuous with those of the ulcerated surface, and which soon become the base of a solid cicatrix, adhering to the bone, and presenting an excavation proportioned to the loss of substance which the bone has sustained.

It may be readily conceived that the progress of the disease is somewhat modified, when it arises from an external cause, which has produced a wound or mortification of the skin and other soft parts which cover a bone.

When necrosis extends quite through a bone and the periosteum of both its sides, granulations, formed from its parenchymatous substance, become the base of the cicatrix. There is no regeneration of parts to repair the lost substance, either in this case, or when the disease is confined to a part only of the thickness of the bone. When necrosis affects only the medullary part of a bone, the external portion swells, and forms granulations ; the sequestra becomes separated, and is enclosed in the living bone. A new process of nature is then necessary for its discharge.

When the periosteum of one or both sides of the bone is affected, the disease commences with much more serious symptoms, because a greater extent of bone is commonly mortified. The patient is affected with acute, deep-seated, and constant pain, occupying a greater or less extent ; insomnium, loss of appetite, fever, with an exacerbation towards evening, or during the night, and accompanied with pain, thirst, copious, but generally partial, sweats. The periosteum becomes thickened, and more vascular ; it separates from the dead bone, and the interval between them is filled with a gelatinous, or rather albumenous fluid, which,

in time, becomes more consistent, adheres to, and is at length identified with the periosteum. Small spiculæ and scales of bone are formed in this mass; they increase in number, and form a thick solid substance. Finally, the bony structure becomes evident, and the thin stratum of soft parts next the sequestra, forms a new internal periosteum.

If the disease be seated in a flat bone, the phenomena will be different, according as the periosteum is preserved on both surfaces of the bone, or only on one; and also according as the mortification involves the internal periosteum or not. In this last case, there appears a soft, doughy, deep-seated, un-circumscribed tumour, painful on pressure, but without any external inflammation. After a time, fluctuation may be perceived, the skin inflames and ulcerates, a large quantity of pus is discharged, and the bone is found bare beneath the soft parts; new collections form, and open, the orifices re-maining fistulous; finally, the dead bone becomes loosened and detached, by the pressure of the granulations below. In those instances in which the periosteum of both sides of a broad bone remains unaffected, the sequestra becomes en-closed in a case, formed by the double layer of new bone united at its spongy extremities, which are never affected. In this case, the separation of the sequestra is easy; but it cannot be removed without the aid of art.

It does not appear that the dura mater, which performs the office of an internal periosteum to the bones of the cra-nium, is capable of that inflammatory process by which new bone is formed. Saviard saw the greater portion of a cra-nium lost by necrosis; and, in this case, the cicatrix re-mained thin, and agitated by the movements of the brain. We must not mistake for a new production, the thin ex-pansion which proceeds from the opening made by a trepan: this is simply the effect of the sinking of the two tables of the skull, and the swelling of its diploe.

The symptoms of necrosis are somewhat modified, when it affects the whole thickness of the bone, and all, or nearly all, its circumference. If the periosteum be mortified while the medullary membrane preserves its vitality, the first of these parts becomes separated from the surrounding organs, and an enormous abscess forms, which opens in several places. During the process of suppuration, the medullary membrane inflames, swells, and thickens; its cellular la-mellæ become more dense, and are confounded with their common covering, which separates from the medullary sur-face of the bone; and we find in the interval between them, a layer of albumen, like that of which we have already

spoken. In this new substance we soon see red points ad-
hering to the medullary membrane, and quickly confounded
with it in colour and consistence, and forming an opaque,
whitish, homogeneous body, in the centre of which bone is
developed. Sooner or later the sequestra separates, and
escapes in small pieces, through the fistulous openings,
while the new bone daily increases in volume and consist-
ence.

If the medullary membrane be mortified while the peri-
osteum remains unaffected, the latter inflames, and swells
in some points; suppuration takes place; the abscesses open,
and we can pass a probe through the orifices to the cavity
which contains the sequestra; the dead bone is discharged
through these orifices, either wholly or in part; and if a
portion remain behind for a length of time, it will occasion
hectic fever.

Necrosis rarely affects the articular ends of cylindrical
bones; when it does, the case is highly dangerous.

In most cases of necrosis, the sequestra is long, slender,
and irregular. It appears externally at several points; but
still it is nearly, or quite immoveable, even after it is en-
tirely detached from the surrounding bone.

Experiments made upon living animals teach us, that, in
cases of fracture, attended with the destruction of the peri-
osteum, or that of the medullary membrane, or mortifica-
tion of the bone, the reproduction takes place from the side
of the two membranes which has been preserved; and that
the new substance extends, without interruption, over the
solution of continuity, and unites the bones. But we are
ignorant of the manner in which a cure would take place, if
necrosis should affect the body and whole articular extre-
mity of a long bone.

Necrosis is generally much more rapid in its progress,
and much more dangerous, when it has been produced by
external violence, than when it is a consequence of syphilis
or scrofula. In the latter cases, the greater part of the tibia,
humerus, and femur, has been known to come out through
fistulous openings; and, after a great length of time, nature
has effected a cure, without the patient's having thought it
worth while to take medical advice.

Necrosis of a superficial part of a bone, involving the
periosteum, first appears in the form of a tumour, accom-
panied with acute and deep-seated pain. The tumour is, at
first, small, hard, and elastic; afterwards it enlarges, soft-
ens, and becomes fluctuating. When the tumour opens, the
bone is found rough, and it does not appear red, or covered

with granulations. After a time, the surface of the bone is elevated. When pressure is made upon it, pain is excited, the sequestra is seen to move, and a few drops of blood are squeezed from beneath it.

When necrosis affects the diploe and periosteum of a flat bone, or the medullary surface of a long bone, it causes, in the part, violent continued pain, which is increased in the evening or night, and attended with hectic fever. A moderate but extensive tumefaction next takes place, which gradually increases, becomes harder, and less sensible. Fistulous openings form in the part, which discharge a quantity of pus disproportioned to the size of the tumour. The flow of pus is not promoted by pressure. A probe introduced, passes to a great depth, and touches a hard, rough, insensible mass of bone, at first fixed, but afterwards moveable and vacillating.

Necrosis is not commonly a dangerous disease ; but, when it is extensive and deep-seated, it may induce fatal colliquative symptoms. Generally, however, the limb is restored to its functions, unless the disease affect the articulations ; in which case, amputation is commonly the only means of saving the patient's life.

In the treatment of necrosis, its exciting causes, such as syphilis, scrofula, &c. must be combated by appropriate remedies.

As to the local indications in superficial necrosis, they are very unimportant. It is proper only to make small openings through the skin, in order to discharge the matter, before that membrane is so thinned and disorganized that it will not re-unite. Occasionally it is necessary to enlarge the opening through the soft parts, after the sequestra has become loose ; but, generally, nature requires no assistance of this kind.

The treatment of deep-seated necrosis consists principally in the use of emollient, relaxing, and sedative remedies, externally and internally. As the disease continues a long time, we must not bleed the patient unnecessarily, nor keep him too low. When we are able to feel the sequestra with a probe, we should endeavour to judge whether nature will be able to effect its separation. An operation for the removal of the sequestra is rarely necessary, and is always to be avoided if possible, since it necessarily weakens the new-formed bone, destroys a portion of it, and sometimes even occasions a new necrosis. The surgeon should, therefore, support the patient's strength, prescribe opiates, &c. and not operate until delay would endanger his life. If

the limb become bent, at one of the openings, by the action of the muscles, we may augur well, since its incurvation will probably permit the sequestra to come out.

If we be obliged to remove the sequestra by art, we should make a semi-elliptical incision on each side of one of the largest and most superficial openings: the skin and soft parts included within these incisions are to be removed. If much blood flow, the wound ought to be covered with dry lint, and left until the next day. The opening through the new bone is then to be enlarged, so that we may get hold of one of the ends of the sequestra. A trepan is the best instrument we can employ for this purpose. It is better to make several perforations with this instrument, than to use any violence in extracting the dead bone. It has been proposed to employ a strong bistouri; but, unless we operate prematurely, the bone will be found too hard to be divided with this instrument. If we be not careful to avoid pressing hard upon the new-formed bone, we run the risk of bending it, or of exciting great inflammation.

After the sequestra is removed, the cavity of the wound is to be gently filled with lint; over this should be placed a piece of soft linen covered with cerate, and the whole covered by a poultice. The limb is then to be adjusted in a convenient position. Copious suppuration will follow; and slight exfoliations, from the parts which the instruments have divided, will take place; the new bone will gradually become smaller, and the cicatrix will at length close.

After the cure, the patient must be kept at rest until the new bone has acquired sufficient solidity to perform its functions.

CHAPTER XX.

Of Caries.

THE nature of caries is entirely unknown. Until very lately, it was confounded with necrosis. In the present state of our knowledge, it is impossible to give a definition of this disease; but its phenomena are evidently the result of vital properties. A carious bone is the seat of pain, more or less acute, constant, and affecting the health of the patient. Sometimes it is swollen, softened, pliable, and more or less partaking of the consistence of the soft parts. Sometimes it retains its natural coverings; when it is separated from them, fungus often arises from the exposed surface: ill-conditioned, sanious, fetid pus is secreted. Nature makes no effort to separate the affected bone, unless, perchance, the disease change to necrosis. With this single exception, the disease makes constant progress: small bones, it is true, are separated; but this separation produces no favourable change, and bears no resemblance to necrosis.—Caries has been compared to ulceration of the soft parts. Though this comparison may illustrate the difference between this affection and necrosis, yet it is far from being proved that caries is an ulcer of a bone.

Caries most commonly affects the spongy structure of the bones: hence the bones of the carpus, those of the tarsus, the bodies of the vertebræ, the thickest parts of the scapula, and os innominatum, the whole of the sacrum, the sternum, the mastoid process of the temporal bone, and the extremities of the long bones, are the most frequent seats of this disease. It attacks children most frequently, and makes more rapid progress in them than in older persons.

Sometimes a carious bone preserves its natural form and consistence; but most commonly it is enlarged, dry, and brittle; or it becomes soft and compressible.

Contusion is believed to be capable of causing caries, but we almost always find it connected with an internal cause, such as scrofula, scurvy, &c. We cannot decide whether the disease of the articular extremities of large bones, which arises from wounds of the joints, be truly caries or not. The presence of pus and the pressure of tumours are incapable of causing this disease.

The internal causes of caries are, syphilis, scrofula, scurvy, cancer, gout, and rheumatism; the metastases of the

virus of small-pox, measles, and of critical translations of certain acute diseases.

Syphilis produces caries more rarely than necrosis. When caries arises from syphilis, that disease must have existed a long time. In this case, the nasal fossa, the roof of the mouth, the mastoid process of the temporal bone, and the sternum, are the parts most frequently affected.

Caries of the bones of the wrist, foot, ankle, knee, elbow, and shoulder, are commonly the consequences of scrofula.

Scurvy is most apt to produce caries of the more compact parts of the bony system. In these cases, we find no swelling or exostosis of the affected bone—a circumstance which characterizes the highest degree of that disease.

Cancer produces caries in no other manner than by extending from the affected soft parts to an adjacent bone.

Rheumatic white swellings, and lumbago, sometimes lead to caries of the bones of the knee and vertebræ. Gout also may produce caries of the bones of a joint in which it has long existed. The concretions and fistulæ which occasionally form in that disease, leave the bone rough and carious.

The pressure on the sacrum and other bones, which takes place in chronic diseases, is not of itself sufficient to cause caries; it must be aided by the translation of the general disease to the part.

There is another cause of caries, of which no author has spoken, and which unhappily is too common—I allude to masturbation. A great number of facts prove that it may produce deformity of the spine, and a greater number still, that it may cause a caries of the vertebræ. We have had numerous cases of caries of the vertebræ, the greater number of which, excepting among scrofulous infants, were occasioned by the vice to which I allude. We cannot explain this fact.

The signs of caries are, 1st. A fixed pain, more or less violent, in a bone whose structure is favourable to the formation of caries. 2d. An abscess by congestion in a part more or less remote, commencing with a tumour, fluctuating from the beginning, and followed by inflammation of the integuments; but never preceded by subcutaneous inflammatory congestion. 3d. The opening of this abscess remaining fistulous, furnishing a disproportionate quantity of pus, which daily becomes more fetid, and affects the health of the patient. 4th. The discharge of very small irregular pieces of bone with the pus, and deformity of the part where the bone is affected.

A spontaneous cure of caries rarely takes place; but, when the disease depends upon syphilis or scrofula, it some-times gets well without the aid of art. The cure, however, takes place in different ways, in these two cases: in the for-mer, it becomes converted into necrosis, and the dead bone is separated like an eschar of the soft parts; and, in the latter, all the symptoms gradually subside, and the patient recovers, without any exfoliation taking place. This favour-able change is most likely to happen at the age of puberty. Without the aid of art. however, caries almost always proves fatal, by inducing colliquative symptoms; or it keeps the patient in a state of unnatural susceptibility to the general causes of disease.

The general treatment of caries depends upon the disease which has given rise to it; commonly, however, caries con-tinues after its cause is destroyed. Local treatment then becomes necessary: this must vary according to the extent, situation, and nature of the disease. It is remarkable that almost all authors have recommended the application either of irritants or heat: though the latter of these remedies was misapplied to cases of necrosis, yet the unanimous con-sent of antiquity in favour of it as a remedy for caries, is certainly founded upon observation.

When caries is superficial and recent, we may derive ad-vantage from topical baths and ablutions of a decoction of bitter herbs, or a weak solution of potash. The strength of the solution should only be so great as to impart an evident taste when applied to the tongue; the strength may after-wards, be increased but very gradually, lest it inflame the skin. This remedy, which I have often seen successful, re-quires to be used a long time. I knew a shoemaker who had caries of the ankle, for which amputation was judged necessary: some circumstances, however, delayed the ope-ration; and the patient, in the mean time, bathed the part with ley, which produced ancylosis, and a cure. When a bone is laid bare, alkohol, or tincture of myrrh, aloes, &c. may be applied with advantage.

It is not probable that these means ever succeed in curing caries when it is deep-seated; in such cases, we must con-vert caries into necrosis, by producing a mortification of the affected bone, and inflammation of the surrounding parts. For this purpose we may employ mineral acids, liquid me-tallic salts, or any other liquid caustic.

The ancients made great use of the actual cautery: this undoubtedly is the most powerful, certain, and expeditious means of cure; it is more conveniently applied than caus-

ties, acts to a greater depth, and is less apt to injure the soft
parts ; these may always be protected by covering them with
wet cloths, or by passing the iron through a cannula.

It is often necessary, before we apply the cautery, that
the bone should be laid bare, unless it be very deep seated.
We should have three or four irons ready, of suitable
form and dimensions. and heated to a white heat. If
the bone be affected with moist caries, or filled with fungus,
the first iron does little more than evaporate the fluids it
contains, and it is necessary to apply several irons in suc-
cession. The operation is not very painful ; if, however, a
severe and lacerating pain do succeed, and the fungus
shoot up rapidly, there is reason to fear that the disease is
cancerous, and further cauterization would be more danger-
ous than the malady it was intended to relieve.

There are no means of judging when the action of the
hot irons has extended to all the carious bone ; but we may
form some judgment of the degree of cauterization neces-
sary, by comparing the depth of the caries, (as ascertained
by the introduction of a probe,) the humidity of the carious
bone, and the quantity of fungus which penetrates it, with
the size of the irons. and their degree of heat. If, a few
days after the first cauterization, the patient experience no
pain, nor the inflammatory symptoms which announce that
the sequestra is about to be separated, or if the fungus be re-
produced, the operation must be repeated. The success of this
truly heroic remedy depends entirely upon this circumstance.
When properly employed, the actual cautery is always suc-
cessful, except in cancerous cases. It would be fortunate if
every case of caries admitted of its application.

The actual cautery cannot be applied to caries of a joint,
nor to very extensive or deep seated caries. Sometimes it is
necessary, first to remove the greater part of the caries, and
cauterize the remainder. The actual cautery ought never to
be applied to any part of the cranium, except the mastoid
process.

When caries, seated in an articulation, remains stationary,
we can do no more than keep the patient at rest, and give
him tonics and a generous diet. If hectic fever supervene,
and threaten the life of the patient. amputation is the only
resource : but this operation should never-be resorted to
until hectic symptoms take place.

Resection of the articular extremities of carious bones
has been proposed as a substitute for amputation. In our
opinion, this operation is only applicable to caries of the
shoulder ; because, in this case, the disease may be confined

to the head of the humerus, and, if it extend to the glenoid cavity of the scapula, the hot iron may be there applied. The whole operation is simple, though severe. In all other cases the preservation of the limb would be too dearly bought.

Some cases of caries, from their extent and depth, are necessarily fatal. In such instances, we can only discharge the pus by small openings, and support the patient's health.

ARTICLE I.

Of Caries of the Bones of the Cranium.

These bones are more frequently affected with necrosis than caries. However, this last disease is not unfrequently caused by syphilis. It most frequently attacks the mastoid process; in which case the hearing is almost always destroyed.

When the disease commences in the external table, a swelling of the soft parts is simultaneous with the affection of the bone. A doughy tumour forms, which is slightly painful, and adherent to the parts beneath: afterwards this inflames, opens, and discovers a diseased bone. When, on the contrary, the internal table of the bone is primarily affected, great pain takes place, and exists a long time in the same spot, without any appearance of disease. It is generally accompanied with vertigo, convulsions, lethargy, blindness, and other symptoms of compression of the brain. At length an external tumour appears, corresponding to the original seat of the pain; it is small in extent, slightly painful, and fluctuating from the commencement; its size is variable, and compression sometimes diminishes it. When the tumour ulcerates, we perceive an opening through the cranium, of which the edges are thin, irregular, and tapered off, by the destruction of the internal table. Pressure does not promote the discharge of pus, which is very abundant. When this second species affects the mastoid process, purulent matter is discharged from the ear. In this case, the meninges, and even the brain, are generally affected. Of course the disease is very serious.

Caries of the external table may generally be cured by the application of alcohol, tincture of myrrh, and aloes, or liquid caustics; and these applications are without danger. But when the disease affects the internal table, it is far more difficult to manage. The actual cautery is inadmissible,

except in caries of the mastoid process, and other applications are ineffectual and dangerous.

When the internal table of the cranium is carious, the dura mater separates from it. This circumstance facilitates the use of instruments, for the removal of the carious bone, and this should be effected as exactly as possible, by the rougine, trepan, centicular, a small round saw, &c.　What is left of the carious bone should be destroyed by topical applications, applied with all possible circumspection.*

If, in the operation, we perceive that a portion of sound bone projects into the carious part, we must cautiously avoid injuring it, as it will serve to support the cicatrix, and diminish the deformity.

When fungus shoots out from the dura mater, as is generally the case, it should be washed with some slightly stimulating lotion, as lime water, the water of Balaruc, &c.

ARTICLE II.

Of Caries of the Vertebræ.

It is very important to understand this disease, because it is frequent and fatal.

There are two remarkable varieties of it : in one the caries is superficial ; it appears only to attack the circumference of the body of one or more vertebræ, while the rest of the bone remains unaffected.　In the other, the whole body of one or more vertebræ is, from the beginning, softened or swollen.　It sinks under the weight of the body ; the spine is bent backwards to a point ; the spinal marrow is injured, and the parts below the seat of the disease are rendered weak, and occasionally paralytic.　Pott first accurately described this particular kind of palsy of the lower extremities, which now bears his name.　In the first case, and sometimes in the second, the pus which is formed about the affected parts, runs along the cellular tissue, and forms abscesses by congestion.　Of these we have already treated.

The bodies of the vertebræ are most frequently affected ; sometimes, however, the transverse processes become ca-

* See the Memoires of the Academy of Surgery, vol. i. page 265, for an account of a very daring operation of this kind, performed by the celebrated La Peyronie.

rious. The caries of the body alone requires particular consideration.

This disease generally attacks children, at that period of life at which the scrofula, of which it is often the consequence, first shows itself; it, also, is common among adolescents. The cause of this has been already stated. We cannot have a just idea of the frequency of the cause which has been pointed out; it is not only productive of the disease among young persons, but even among children. Next to this cause and scrofula, rheumatism most frequently occasions caries of the vertebræ; it produces superficial caries most frequently in adults. A blow, a fall, or a strain of the spine is often spoken of as a cause of this kind of caries ; but it is probable that these are only fortuitous occurrences, or effects of the disease.

When caries of the spine is superficial, the patient complains of a constant, deep seated, but moderate pain. The ligaments of the anterior part of the spine become separated, and in the interval thus formed, pus is deposited, which soon produces an abscess by congestion.

When the spongy structure of the vertebræ is diseased to a great depth, the spinous processes of one or more of these bones is raised so as that its axis is nearly horizontal. This deformity is noticed before the occurrence of pain in the part. But it is generally preceded by a sensation of pricking in the thighs, weakness of the lower extremities, an uneasy sensation in the stomach, and constriction of the chest, which renders breathing difficult; the pain in the back is always moderate, and never increased by pressure. The patient, after some time, lays altogether on one side, with his legs slightly flexed, the neck strongly extended, and the face turned upwards. These last phenomena are remarkable, especially when the dorsal vertebræ are the seat of the disease. The patient walks with his feet near each other, and with slowness and precaution; the hands are first left hanging by the side, and afterwards they are rested upon the thigh ; in sitting down, the body is bent entirely on the pelvis. When the patient is about sitting down, he presses the palms of his hands against his thighs, and bends his body upon them. When he wishes to pick up any thing from the ground, he separates the lower extremities, bends the legs and thighs, supports the weight of his body with one hand on the corresponding thigh ; with the other hand he takes hold of the object either on one side or between his knees, never before them. All these are so many contrivances to prevent motion of the vertebræ either to one side or forward. As the disease

progresses the weakness of the lower limbs increases; the feet are raised very little in walking; the patients stumble and fall; the legs cross each other; afterwards they cannot walk without aid; and, finally, they can neither walk nor stand. But even at this period of the disease, the efficacy of proper treatment would lead us to believe that the continuity of the vertebræ is not destroyed. The spinal marrow is probably stretched, by the change in the form of the vertebræ, and compressed by the swelling of the cellular tissue which surrounds it. This latter cause must have great influence, since we are often able to restore the functions of the lower limbs without relieving the curvature of the vertebræ. If the disease is left to progress, the affected vertebræ become diseased in every part, pus collects in front of the carious bones, an abscess by congestion is formed, and the patient at length dies. On dissection, we find the bodies of one or more vertebræ destroyed, as far back as the posterior lamina and transverse processes. The adjacent vertebræ are eroded and fallen in, so as to take the place of the lost substance, but not united to each other. Sometimes the intervertebral substance and ligaments are destroyed; the process of the dura mater, which lines the vertebral canal, and the spinal marrow, are not visibly affected. We find, also, one or more cavities or sinuses filled with pus or carious matter. What is surprising, we frequently meet with irregular bony productions, generally oblong, stalactiform, and compact; often larger than the body of a vertebra. We sometimes find them floating in the pus, and at other times adhering to the inner surface of the sac.

The difference between caries of the vertebræ and gibbosity is very great. In the latter disease there is never any formation of pus, or destruction of bone; the curve almost always is lateral; the lower limbs are never affected. It is remarkable, also, that the paralytic affection of these parts, which takes place in caries of the vertebræ, differs from paralysis properly so called, in this; that, in the latter, the muscles are relaxed and often shrivelled; in the former, on the contrary, they continue firm and plump.

This disease often makes alarming progress before its existence is suspected.* As it is of the greatest importance to discover it as early as possible, we should carefully examine every child that is unable to walk at the ordinary period; or who, having began to walk, is no longer able to do so; and even those, who, without apparent cause, become sad, sul-

* See note D.

len, peevish, and indifferent to the amusements of their age.

Scrofula, masturbation, and rheumatism, as causes of caries of the vertebræ, are severally dangerous in the order in which they are mentioned. This disease is more dangerous in adults than in children. The most we can do in any case is to prevent an increase of the deformity, and this can only be effected by the prompt use of the most energetic means. When the disease terminates favourably, the diseased vertebræ fall together, and become hard and adhere. This evidently shows the inutility and absurdity of mechanical contrivances to straighten the spine.

We are indebted to Pott, not only for the first accurate description of this disease, but, also, for the proper mode of treating it. He proved, and the experience of all succeeding surgeons has proved, beyond doubt, that a copious suppuration, kept up for a long time in the subcutaneous cellular tissue, which surrounds the projecting part of the spine, is the surest and best remedy. We can safely assert, that this remedy has never deceived us; we have always found it successful, if employed before pus was formed, and we have always found that the patients have died when it has been neglected. We have even found it useful as a palliative remedy when an abscess by congestion has been already formed.

We have not found setons or issues made with a knife or moxa so useful as these formed with caustic potash. We make one issue, in urgent cases two, on each side of the projecting part of the spine. Each issue should be large enough to contain three or four pease, or, what is better, a ball of iris of the same size. When the suppuration flags, it must be promoted by applying blister ointment; and, when this is not sufficient to keep up a copious flow of pus, we should form new issues, and heal up the old.

The good effects of this treatment are soon manifest; but it must be continued a long time, several months, or even years, to effect a cure. At the same time general remedies should be administered according to the nature of the case.

We believe issues are useful in every stage of caries of the spine; they ought to be formed even when they can only act as palliatives.

Rest and irritating applications to the spine can do no injury, if employed conjointly with issues; but they are little capable of producing any amendment.*

We beg leave to refer the reader to the chapter on abscess

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* See note E.

by congestion, in the first volume of this work, for our opinion of the advantage of making a small oblique opening for the discharge of pus in such cases.

We shall conclude this article with the following cases.

CASE I.   A. Laporte, aged seventeen years, fell from a height of thirty feet upon his right haunch.   He lost his recollection, and his urine came away involuntarily. No injury was discoverable.   He was bled three times, and, at the end of six weeks, he could rise from his bed, and set in an easy chair.   He had acute pain in the loins, and great weakness of the legs.   Three months after the accident he entered the hospital Charité.   The spinous processes of the sixth and seventh dorsal vertebræ projected backwards; the paraplegia was almost complete.   We learned that the man had long been guilty of an abominable vice.   We formed two issues, one on each side of the tumour; they were too small; we made others of a larger size.   The relief was moderate and transient.   Nothing could induce Laporte to abandon his vice, although the representation of his danger brought on paroxysms of despair.   The disease made sensible but slow progress; the pains in the back continued; the paralysis of the lower limbs became more complete; a new caries appeared at the junction of the last vertebra with the sacrum. The wretched man languished, his countenance sunk, the fear of death harrassed him, and he left the hospital in despair, seventy-five days after his entrance.

CASE II. On the 13th of January, 1809, I was called to see a son of M. Gilmer.   He had enjoyed good health until the age of four years. There was a remarkable projection of the spinous process of the sixth dorsal vertebræ.   A surgeon, who was consulted, made light of the matter, saying, that the child would outgrow the disease.   At the age of nine years the deformity had much increased; the child could walk very well, but daily lost flesh.   The surgeon applied a particular kind of corset. This subjected the patient to frequent cough and syncope, and it was relinquished after six months trial.   For three years more, similar preposterous remedies were resorted to, and the child's health was fast declining. I was called to the boy, who was then fifteen years old. The curvature of the spine formed almost a right angle; the paraplegia was complete; the urine was discharged at long intervals, and with difficulty; respiration was very laborious; the fæces were passed only once in three or four days, and involuntarily; the boy was often choaked, and frequently fell into syncope.   I formed four issues around the tumour, each large enough to hold four or five pease.

February 15—The suppuration copious; the discharge of urine and fæces less painful; sensation of creeping pain and cramps shooting through the lower extremities; pains in the back and chest somewhat diminished; towards the end of two months motion of the toes and feet was restored.

In the course of the month of March the lad felt a desire to pass his urine and fæces, which were afterwards discharged voluntarily and without pain; movements of the legs still very slight.

In the beginning of April the patient could stand, but was unable to walk.

In the course of the month of May the patient was able to walk across his chamber. He took chicory for two months.

In August the patient could walk a mile daily with the aid of a cane, and an arm. One month afterwards he walked without any assistance.

At the present time, (March, 1810,) the patient has still four issues on his back. The deformity is the same as when I was first called to him, but he has grown. The discharge of urine and fæces is perfectly natural, and his walk is firm; some slight and transient pains are occasionally felt in the ribs.

ARTICLE III.

Of Caries of the Sternum.

The spongy structure of the sternum, and the distance between its tables, renders it peculiarly susceptible of caries. Scrofula often exercises its ravages upon this part; a common symptom of confirmed syphilis is an exostosis or periostosis of the sternum; a critical abscess or contusion of this bone are also enumerated among the causes of caries, but we doubt if the latter be capable of producing it without the aid of other concealed causes. We are much in the dark respecting the phenomena of simple or healthy suppuration of the spongy structure of the bones.

Scrofulous caries of the sternum may commence in the inner or outer surface of this bone. It occurs most frequently in children, and is often complicated with tubercles in the mediastinum, or lungs. Not only the whole of the sternum, but even the cartilages of the ribs are often carious. In each of these cases the pleura is pushed back and thickened. It often becomes converted into cartilage, and even

into bone : thus the pus which is formed between the ster-
num and the mediastinum is prevented from coming in
contact with the viscera of the thorax.

In some rare instances, however, in which the mediasti-
num has mortified, or merely ulcerated, the heart has been
exposed so as to be visible. But even in these cases the dis-
eased membrane contracts a firm adhesion on the borders of
the mortified or ulcerated part, and thus prevents any exter-
nal communication with the cavity of the lungs, which, un-
like that of the heart, is never opened.

Beside the general signs of caries, we find, in caries of the
sternum, other symptoms which indicate the presence of pus
behind that bone :—A probe passes easily into the fistulous
openings which surround it ; pus flows out in the movements
of respiration ; if the lungs are affected, there is uneasiness
and oppression in breathing, which leads the patient to choose
a particular position to lie in, together with cough, expecto-
ration, &c.

Such cases generally prove fatal ; but simple caries of the
sternum may be cured. Even when left to nature a favour-
able termination has been known to take place, by the exfoli-
ation of the whole bone, which was detached in very small
pieces.

When the disease is superficial, and not extensive, the irri-
tating applications, of which we have spoken, will be suffici-
ent. In more serious cases it is necessary to remove, with a
rougine, or some other similar instrument, the greater part
of the carious portion of the bone, and then employ topical
applications. But we should be cautious of applying liquid
caustics, or the actual cautery.

Whatever be the extent or the depth of the caries, it
may always be removed without danger of injuring the parts
behind, for the bone is isolated. The trepan and the lenti-
cular are the most convenient instruments. If the disease
extend to the cartilages of the ribs, we may remove them
also. We need not fear wounding the mammary artery. This
vessel is buried in the subjacent soft parts, and, therefore,
little liable to be wounded. But were this accident to hap-
pen, the vessel might easily be tied. In performing operations
of this kind, the integuments over the diseased bone, unless
very thin and disorganized, should be turned back, and not
removed. If we are able to remove all the carious portion
of the bone, we have only to heal the wound. If any diseased
part has been left behind, we must apply to it suitable topical
remedies.

In some cases it is impossible to cicatrize the parts com-

pletely. Thus, when the pericardium has been opened, the constant motion of the heart prevents it from forming the base of a cicatrix. Such was the fate of a young gentleman whose case is related by Harvey. In such instances, after destroying the caries, we must adapt an obturator to supply the want of the natural coverings of the chest.

If the abscess behind the sternum be very large, if the patient be hectic, all that can be done is to apply a trepan to the lower part of the sternum; but, in this case, it would be still more advantageous if the abscess pointed near the xyphoid cartilage. In this case we should endeavour to mature it; for a depending fistulous opening would be preferable to an opening made with a trepan.

We shall conclude this article with the following cases, which we hope will dissipate, from the minds of surgeons, every fear of an operation, apparently dangerous, but, in reality, very simple.

CASE I. A young man, in wrestling, received a blow on the sternum, which was not properly treated. At the end of four months an abscess formed, which opened and cicatrized. Some months afterwards another tumour appeared. This also opened, but the opening remained fistulous. Several surgeons were consulted, who agreed that the sternum was carious, but declined operating, from the fear of penetrating into the cavity of the chest. M. Galien was called in. He undertook the operation, after stating to the young man's master, that its success would depend upon the state of the parts behind. He found that the disease did not involve the arteries and veins which pass along the posterior part of the sternum; but when he had removed the diseased bone the pericardium was found diseased, and the heart was exposed. Nevertheless, the patient was completely cured.

CASE II. M. M——, after an acute disease, experienced pain in the sternum; abscesses formed; the openings of which remained fistulous, and discovered an extensive caries of the sternum. After remaining in this situation for several years, he placed himself under my care. The extent of the disease had intimidated every surgeon who had seen him. I was young, and had little reputation to lose. The patient had youth and a strong constitution in his favour. He was willing to submit to any thing to be cured. There were several fistulæ around the borders of the sternum, and particularly toward the left side and the centre: a probe passed to a great depth, I found that not only the sternum, but three cartilages of the ribs of the left side were diseased. The patient being laid on his back, I made two crucial inci-

sions, and dissected back the flaps until all the carious portion of the sternum was laid bare. I insulated the middle third of this bone with a chisel and small saw ; I then divided the diseased cartilages more than two inches from the sternum, and removed the whole. A vast abscess was brought to view. The bottom of it was formed by the pleura and mediastinum united to each other, thickened, cartilaginous, even ossified in some parts, and firmly adhering to parietes of the chest, beyond the diseased parts. The left internal mammary artery, which ran over the superficies of the mediastinum was opened in the operation, but it was easily tied. The integuments were replaced, and the wound healed as well as if it had been made in healthy parts.*

ARTICLE IV.

Of Caries of the Ribs.

The most common seat of caries of the ribs is near their union with the spine, and this, most frequently, is connected with caries of the vertebræ.

It will not be necessary to dwell long upon caries of the middle of the ribs. When it is superficial, and the health of the patient unimpaired, we need only to provide a depending opening for the matter, and administer suitable internal remedies. But if an abscess form behind the ribs, as will generally take place when the caries is deep-seated, we should lay bare the carious part, and remove it. The pleura will form the base of a cicatrix, and, in time, acquire the consistence of cartilage, or even bone. The actual cautery is never applicable to cases of this kind, as it might inflame the lungs.

ARTICLE V.

Of Caries of the Bones of the Pelvis.

The structure of the sacrum has so strong a resemblance to that of the sternum, that most of what we have said of

* In the year 1791, my friend, M. Genouville, surgeon to the Military Hospital of Val-de-Grace, performed a similar operation, in my presence, with complete success.

the former applies also to the latter. When caries attacks the sacrum spontaneously, or from internal causes, that side of the bone which is next the pelvis is almost always affected. In these cases purulent collections take place, and appear in parts more or less distant, forming true abscesses by congestion, and accompanied with all the dangers attendant upon these diseases. We ought, therefore, to examine with the greatest attention abscesses and fistulæ about the anus, perinæum, and buttocks, especially if they have been preceded by deep-seated and constant pain in the region of the sacrum; and never lose sight of the symptoms of abscesses by congestion, lest we fall into gross and fatal errors.

The crest of the ilium, its tuberosity, and that of the ischium, are also very liable to caries. The deep situation of most of these parts, as well as the slow progress of the disease, allow the pus to remain for a great length of time, and pass to a great distance, without causing any alarming symptoms. The tumour which it produces is also very equivocal, on account of its form. When, therefore, we see soft, fluctuating, indolent tumours, with a large base about the pelvis, or upon the posterior or the internal part of the thigh, we should inquire if they have not been preceded by dull, deep-seated, fixed, and constant pain in some part of the bones particularly liable to caries. Unless we make these inquiries, the patients, not suspecting any connexion between the swelling and the pain, will leave us ignorant of the true nature of the disease.

In all these cases the treatment is exactly similar to that of abscesses by congestion, which has already been laid down. Although the articulation of the sacrum with the bones of the ilium is very strong, external violence may produce a divulsion of these bones, the secondary consequences of which are extremely serious. They may, also, become relaxed in females during the progress of gestation, and thus render it very painful, or even impossible to walk. In consequence of these causes, or from rheumatism, a caries of the articular surfaces results, or rather that particular affection which follows wounds of large joints on their exposure to the air. The progress of this disease is much more rapid than that of caries properly so called. The pain is acute and insupportable. The patient is obliged to rest upon his back, a little inclined to the affected side; the corresponding inferior extremity is swollen and extended; voluntary motion is lost, and movements communicated to it produce excruciating pain. The fever, which appears from the beginning, is violent, and has the characters of inflammatory symptomatic

fever. Suppuration most commonly takes place, and the pus appears in the seat of the disease, behind the articulation, or it makes great progress towards the internal part of the pelvis, and points somewhere along the anterior part of this cavity. This disease, which ought to be considered as an inflammatory affection of an articulation, rather than caries, is almost always beyond the resources of art, and rarely is cured by the power of medicine.

We have already suggested our doubts as to the nature of the affection of the posterior part of the sacrum, which arises from lying a long time on the back. In fact, in a great variety of cases, notwithstanding the alteration in the colour of the bone, which perhaps arises from the contact of putrid matters, its consistence is not changed. It is probable, therefore, that this affection has more analogy to necrosis than caries, especially when we consider that exfoliation is not always necessary for the cicatrization of the ulcers; and that, when it does take place, nature requires no particular assistance, and the disease is always light.

If, in some rare cases, we observe true caries, it arises from an internal cause, which has acted particularly upon the bone, and not from mortification of the soft parts.

When caries evidently exists in the sacrum, we may use the actual cautery with safety.

The parts of which the os coccygis is composed may be affected with caries. They are so small that they may be quickly separated from the soft parts, and may be extracted without difficulty after a certain time.

The disease of the acetabulum, which is known by the names morbus coxendicum, or spontaneous luxation of the femur, will be treated of hereafter.

We shall terminate this article by two cases, which will show the danger of caries of the bones of the pelvis.

Case I. A taylor, aged fifty years, of a bilious temperament, came to consult me for a flattened, circumscribed, indolent tumour, without alteration of the colour of the skin, and situated at the right posterior part of the pelvis, below the tuberosity of the ilium. The patient, from his youth, had been subject to wandering rheumatic pains. A fixed, but not intense pain towards the posterior spine of the bones of the ilium, had preceded the developement of the tumour in question. I directed a soap plaster to be applied, and advised the patient to call upon me from time to time. At the expiration of two months the tumour was larger than before, soft and fluctuating. The patient entered the hospital. A few days afterwards I opened the tumour with caustic.

A large quantity of sanious, inodorous matter was dis-
charged for a month. At the end of this time the discharge
was more copious and fetid; hectic fever and diarrhœa
came on; the legs became anasarcous, and the patient died
three months after he entered the hospital. On dissection,
we found a fistulous sinus which extended from the external
opening to the posterior spine of the bones of the ilium, pas-
sing before the gluteus maximus. The bone was carious to
a great depth.

CASE II. A healthy woman, aged thirty, by profession a
cook, complained for a long time of a dull and deep-seated
pain in the posterior part of the os ilium of the left side, with-
out any sensible alteration of the form of the part. After-
wards, however, the buttock swelled, but there was no pain,
nor alteration of the colour of the skin. The patient pursued
her employment without being much incommoded by the tu-
mour. A fall upon this part caused it to sink; but a new tu-
mour formed in the posterior and upper part of the thigh,
which, at length, extended to the ham. The patient con-
sulted me ten months after the pain came on, and six
months after the appearance of the tumour. It was prodi-
giously large, indefined, occupying the whole buttock, indo-
lent, without inflammation of integuments, and presenting a
deep fluctuation. All the posterior part of the thigh, quite
to the ham, formed a tumour, separated from the first by
the angle of the buttock, without inflammation of the skin,
indolent, soft, and fluctuating. By compressing, alternately,
these two tumours, I perceived that the matter passed from
one to the other. Notwithstanding the slightness of the pain
which announced the commencement of the disease, I au-
gured ill of the case. The patient having entered the hos-
pital, I made three successive punctures, with a narrow bis-
touri, at the most depending part of the tumour of the
thigh, and carefully placed the lips of the wound in apposi-
tion. The third puncture did not close, and the purulent,
grumous matter, which was discharged after every opening,
continued to flow through it. The matter then became fetid,
fever supervened; and the patient, perceiving herself sinking,
desired to return home, where she died two months after-
wards. An intelligent student, whom I had directed to
examine the body, found an extensive caries of the posterior
and superior part of the os ilium.

CHAPTER XXI.

Of Exostosis, Periostosis, Spina-Ventosa, and Osteo-Sarcoma.

THESE organic affections of the bones differ from each other as regards their seats, their causes, their progress, and their terminations. We shall, however, consider them in this chapter, because they have one circumstance in common—that of altering the vital properties and the structure of the organs they affect. In this circumstance, perhaps, they resemble caries, properly so called.

Although we have numerous cases of these diseases on record, they are far from furnishing a natural series of facts, in which we can trace any evident connexion between causes and effects. Organic affections of the soft parts may generally be traced to some known cause, and the study of morbid anatomy daily increases the sum of our knowledge. But the organic affections of the parenchematous substances of the bones are concealed from view by the earthy inorganic matter of these parts. Moreover, these diseases are of very long duration, their origin is obscure, and their termination is always uncertain. The same person can rarely follow the whole course of a case ; most of the histories, therefore, of these maladies are incomplete. We cannot too strongly recommend the study of this subject, which is yet in its infancy, notwithstanding the labours of many celebrated men.

A circumstance which appears common to all affections of this kind, periostosis alone excepted, is, that the softening of the osseous tissue precedes every ulterior change. In spina-ventosa and osteo-sarcoma this is incontestible, but is not so evident in exostosis, especially in that kind in which the bone acquires the hardness of ivory : but if we consider that the bulk of the bone is increased, that the compression of tumours upon bones destroys rather than distends them, that in examining the substance of an exostosis, we may generally distinguish, very easily, the fibres diverging from each other towards the surface of the tumour; and that, in many tumours of this kind, we observe some parts hard, irregular, and voluminous; others, of which the cellular structure differs from its natural state only by the space its increased size and diminished density occupies, and others, in which the osseous tissue is reduced to a puffy or fatty substance : if, I say, we consider all these circumstance, it will be difficult to avoid this conclusion.

ARTICLE I.

Of Exostosis.

Exostosis is a tumour formed by an increased growth of
a part or the whole of a bone.   We sometimes find an aug-
mentation of volume and density in all the bones of the same
person, which probably is a species of this affection.

Exostosis affects all the bones, but is observed most fre-
quently in the bones of the cranium, the lower jaw, the cla-
vicles, the sternum, the ribs, and the long bones of the extre-
mities.

Sometimes exostosis appears like a small mass superadded
to the surface of a bone ; sometimes it rises indistinctly, and
resembles a section of a sphere ; sometimes it is pointed, and,
at other times, it is connected with the bone by a narrow
pedicle. The external plate of a bone of the cranium has been
seen covered with an exostosis, while the cerebral surface
continued unaffected ; the whole circumference of the femur
sometimes acquires an enormous size, while the medullary
surface remains healthy. In other instances the whole thick-
ness of the bone is diseased. When this takes place in a cylin-
drical bone, the medullary cavity is diminished, or even obli-
terated.   In some very rare instances the bone acquires the
hardness of ivory, without increasing in size.   If this hap-
pen to a cylindrical bone, the articular surface is commonly
affected.

When an exostosis is not very large, and is seated on the
surface of a long bone, we may trace, with the eye, the di-
vergence of the bony fibres ; the intervals between them are
filled with a new osseous substance, the organization of which
is indistinct. The tumour is sometimes entirely cellular, and
formed of broad plates enclosing large spaces, filled with
a substance different from the marrow.   This is what is
termed *laminated exostosis.*   Sometimes the portion of the
bone grows in the form of a hollow sphere, with thick and
hard sides, the cavity of which is filled with fungous ve-
getations.   This variety must not be confounded with osteo-
sarcoma, from which it essentially differs, notwithstanding its
apparent similarity.   In other instances the tumour is en-
tirely solid, and as hard as ivory, and the surface is continu-
ous, like bone in its natural state; or it is unequal, irregular,
mammalated, and in some degree stalactiform. A part of
the tumour is often pulpy and lardaceous.   It is not uncom-
mon to find the same exostosis as hard as ivory in one part,

lamellated in another, and partly filled with a semi-fluid gelatinous substance.

When the exostosis is very large, it renders the muscles and cellular tissue near it very thin. Small exostoses may injure the functions of certain organs: thus a joint may be rendered stiff, the uretha may be obstructed, the eye may be pushed from the orbit, the brain may be compressed, or the lungs may be prevented from expanding, &c. when an exostosis is situated in the vicinity of any of these parts.

Syphilis is the most common cause of exostosis; but exostosis is always a secondary symptom. Scrofula occasions it sometimes; scurvy very rarely. J. L. Petit saw but only three cases of this latter kind, and these were on the lower jaw, and it may be doubted if they were not venereal. Cancer never causes exostosis. Blows, falls, &c. on the part, can only be considered as exciting causes.

Syphilitic exostosis is uniformly preceded by acute pain; at first in every part of the affected bone, afterwards in the spot where the tumour forms, and always increased at night. In the exostosis which arises from scrofula the pain is either very dull, or there is no pain at all. The exostosis which succeeds to a contusion comes on slowly, and is not painful, except at the time of the accident.

Independently of these circumstances exostosis is acute or chronic. The cellular, or lamellated exostosis is developed quickly, and it is always preceded by violent, acute, and intolerable pain, not much relieved by opiates, nor increased by pressure. The pain often causes severe symptomatic fever; it is owing to the morbid action which is going on in the bone; the soft parts do not partake of it, nor are they swollen.

In the harder kinds of exostosis the pain is much more moderate, or it does not exist at all; the tumour increases slowly, and no constitutional irritation takes place. However surprizing it may appear, exostosis may terminate by resolution, or even by metastasis. We have seen a voluminous exostosis occupying all the lower parts of the humerus: it was of syphilitic origin, and, after having resisted, a long time, scientific treatment, it disappeared quickly and completely on the occurrence of other syphilitic affections in the fauces. These cases, it is true, are extremely rare, and we may lay it down as a general rule, that exostoses are never resolved, even when they are idiopathic and purely local, and that the examples of this termination, which are cited, are cases of periostosis, the nature of which is entirely different, though its appearance is very similar.

In most cases of hard chronic exostosis, without pain or alteration of the bony tissue, the tumour remains stationary for life. This termination, which may be compared to the induration of tumours of the soft parts, is the most desirable, provided the exostosis do not impede the functions of any organ essential to life. But in cellular exostosis, a part of the tumour is generally pulpy or gelatinous, and the rest, still preserving its natural organization, forms one or more collections of pus. The soft parts ulcerate, and leave a portion of the tumour exposed: true caries sometimes supervenes, but this is then a primitive complication of the disease, and not the consequence of the ulceration. When the soft parts are thus ulcerated, the opening contracts and remains fistulous. Suppuration induces hectic fever, which may prove fatal.

Spherical exostoses, with an internal cavity and hypersarcosis, are not accompanied by violent pain, except in their commencement. When they have attained any considerable volume, they become almost indolent; but the successive growth of fungus in the cavity, distends and thins its sides, and may lead to fracture or ulceration; but the affection of the bony tissue is less dangerous than in the former species, where tumours have often been operated upon with success. Whereas any operation would be useless, and even dangerous in the preceding case.

Another mode of termination of exostosis, not mentioned by authors, and which is most apt to occur in the hard and stalactiform kind, is that by necrosis. Large tumours of this kind have been known to mortify, separate from the bone which was their base, and become surrounded with a substance, in every respect similar to that which encloses sequestra. This is, undoubtedly, the most fortunate of all terminations; but it is, also, the most rare; art may imitate it, but imperfectly.

Exostosis appears in the form of a hard tumour, incompressible, united to the bone, and immovable. These characteristics readily enable us to distinguish its periostosis, which is always doughy and compressible. All other tumours, however intimately connected with the bone, may be slightly moved.

But when the tumour appears in the internal sides of any of the bones which surround the cavities of the body, it is difficult to ascertain its existence, and we can only suspect it from the effects it produces.

We may conclude that exostosis has arisen from syphilis, where this disease has existed a long time, and the affection has become general. We infer, that it is scrofulous, when

the patient has other symptoms of this disease, and no other cause is evident.

It is very difficult to judge a priori what are the contents of an exostosis; but it is generally hard when the tumour has been slow in its progress, and vice versâ: yet some scrofulous exostoses are chronic in their progress, without becoming vary hard. It is important to distinguish that state of an exostosis which is disposed to terminate by necrosis: it is marked by the same symptoms that announce the formation of a sequestrum.

The hardest exostoses are generally the least dangerous. Some hard exostoses, after attaining a certain size, remain stationary, or are even capable of being somewhat diminished.

The medical treatment of exostosis consists in the destruction of its internal cause. We shall only remark, that, in syphilitic cases, the mercury should be given for a long time, and in great quantity; that sudorifics, in large doses, are very advantageously combined with it; that a combination of sudorifics, with some grains of potash or soda, has often been employed with benefit, after several ineffectual courses of mercury.

The external application of laudanum, by means of compresses, or added to poultices of linseed, is always useful in abating pain. Depleting remedies are rarely administered.

When there is no pain, or after it has been relieved, we may cover the tumour with mercurial or soap plaster, or we may apply volatile liniment, solutions of potash, or of soda, pumpings of hydro-sulphurous water, &c.

These means, however, are generally insufficient, and our knowledge of the nature of the disease is too limited for us to lay down any internal treatment, further than to fulfil the general indications of each case.

When an exostosis presses upon some important organ, and an operation is required, we should make around the tumour, if it have a narrow neck, two semi-elyptical incisions, raise the flaps, and saw it off. If the bone be sound, the flaps should be re-applied. If we are obliged to wait the formation of granulations from the surface of the bone, the preservation of the skin will facilitate the cicatrization of the wound.

When the basis of the tumour is large, (as is commonly the case,) it is most conveniently removed with a chisel and mallet. The operation is much facilitated by dividing the bone down to its natural level, in several places, by a saw or trepan. The chisel should, also, cut obliquely,

in order to diminish the concussion. But, notwithstanding these precautions, the shock of this operation renders it inadmissible in exostosis of the head, to which the saw alone is adapted.

Unless the tumours are very large, and skin greatly diseased, it should be preserved by making a crucial incision, and dissecting back the flaps. When the skin is diseased in consequence of the distension of a large tumour, the diseased parts may be removed, and the remainder re-applied, after the formation of granulations.

Notwithstanding the natural insensibility of the bones, these operations are not altogether without danger. Petit saw a young gentleman who died in consequence of an ill-advised and clumsy operation for the removal of an exostosis from the cranium. Yet the chisel was not employed, nor is there any mention of erysipelas of the face having taken place. In this extraordinary case, death seems to have been induced by the divisions made in substance of the tumour.

In spherical exostosis, containing fungous granulations, we may, in imitation of Petit, cut away the thin parts of the sides of the tumour, with strong scissars, or bone nippers, tear out the fungus, remove the base of the tumour with a chisel or saw, and apply the actual cautery to the part from which the fungus grows. After this, exfoliation takes place, and the wound heals.

When this species of exostosis is not so far advanced, and the integuments are still healthy, it is impossible to distinguish it from the hard kind. But the moment the saw enters the cavity, we perceive, by the blood which escapes, that the tumour is not solid. We should then make another cut with the saw, by the side of the former. Thus the parts are placed in the same situation as if ulceration had taken place.

If the bone is not very much diseased in cellular exostosis, the tumour may be extirpated by a single cut of the saw. When the base of the tumour is large, we may make a perpendicular division of the tumour from the top to the base. In this state of the tumour the operation is simple, and granulation takes place without exfoliation. But if the granulations are large, flabby, pale, and bleeding at the slightest touch, it is to be feared that the section has been made through the substance of the tumour, and not at its base, and that it will be reproduced, and require the use of the hot iron.

If the exostosis is of very long standing, if the bony tissue is radically diseased, if the integuments have ulcerated

and furnish ill-conditioned pus, and if, lastly, the disease is complicated with caries, hectic fever, &c. any attempts to extirpate the tumour would be highly dangerous. Amputation is then the only resource.

ARTICLE II.

Of Periostosis.

Most authors have confounded this disease with that treated of in the preceding chapter. It is often a symptom of syphilis, and consists in an inflammation and thickening of the periosteum, attended with a specific disease of this membrane, and sometimes with necrosis of the superficial lamina of the bone. It attacks, most frequently, the same parts upon which venereal exostoses most commonly appear, viz. the cranium, especially the frontal, and the anterior part of the temporal regions, the front of the sternum, the external side of the radius, the internal side of the ulna, the internal side of the tibia, &c.

In examining the structure of these tumours, we find them formed of thickened periosteum and cellular tissue, converted into an hemogeneous, greyish, doughy, compact substance, resembling an inflamed lymphatic gland, and still more like old cheese.

Periostosis is always the effect of syphilis. It appears only in the advanced stage of that disease. Its formation may be excited or accelerated by external violence.

These tumours are generally preceded by constant pain, more or less acute, and resembling venereal pains, especially in that they are most severe at night. A swelling then takes place; at first this is moderate, tender to the touch, and circumscribed. Its circumference is insensibly confounded with the bone on which it rests. The tumour adheres to the bone, is inseparable from it, and, in fact, appears like an enlargement of the bone itself. If, to these characteristics, we add that periostosis, while yet small, appears to be hard and incompressible, and that exostosis is, also, a common symptom of syphilis, we see why they have been confounded.

In the progress of the two diseases we perceive their different characters. The periostosis is larger, softer, doughy, [patense,] but not retaining the impression of the finger, and not fluctuating, at least while the skin remains unaffected.

In some cases the pain ceases, the tumour continues stationary for some time, and then diminishes and disappears entirely. This termination by resolution rarely takes place spontaneously, and is not generally brought about by the best directed efforts of art. More commonly after the tumour has acquired a certain size, it remains indolent, becomes harder, and continues in this state for life. This termination by induration may be connected with exostosis.

Lastly, it sometimes happens that the skin which covers the tumour ulcerates, and matter is discharged; the bottom of the abscess is of a dull yellow colour; after some time, a greyish decayed substance is discharged, and the bone is left denuded or covered with red granulations, according as the mortification has affected the whole thickness of the periosteum, or only a part of that membrane.

This last termination of periostosis is the only danger which attends it. It resembles, in every respect, necrosis produced by syphilis.

The treatment of periostosis consists principally in the employment of remedies for syphilis, which is the cause of the tumour, and, in general, if the local disease have not advanced very far, and if there be no local inflammation, we may procure resolution. Under less favourable circumstances a degree of swelling and hardness will remain, which, however, produces no other inconvenience than the deformity it occasions. But general remedies are inefficacious, if not administered before the inflammation takes place. In such cases the tumour follows the course we have described, unless we aid the general remedies by local applications and a suitable regimen. Emollient and anodyne poultices are very useful, when there is great pain and sensibility in the part. After these have been removed a mercurial plaster is proper. We should, also, rub a scruple, or half a drachm, of mercurial ointment on the part. Some authors advise the application of blisters, for three or four hours at a time, as a resolvent. They may have proved useful, but we consider them as dangerous remedies, on account of the inflammation which they may occasion, and which, as we have said, ought to be strongly guarded against.

If, in spite of timely aid, or from neglect of it, the tumour become fluctuating, we should immediately discharge the pus by means of a small opening made with a bistouri. This is preferable to caustic potash, which excites severe pain when applied to inflamed parts.

ARTICLE III.

Of Spina-Ventosa.

This disease was unknown to the ancients. What Hippo-crates says of certain organic affections, and which his com-mentators have translated by the Latin words *sideratio, gan-græna, teredo,* &c. refers to the denudation, caries, or necro-sis of bones. Celsus appears to speak of this disease more positively, but his language is very obscure. The Arabians, however, had a particular name for it, which has been rendered into Latin by the terms *ventum spinæ, spinæ vento-sitas, ventum* or *flatum spineum,* and *spina-ventosa.* But they evidently confounded it with other diseases.*

By spina-ventosa is understood a disease of the cylindrical bones, in which the sides of the medullary canal undergo a slow, successive, and sometimes an enormous distension, while, at the same time, they are considerably thinned, and even pierced in several points, or their tissue is exceedingly rarified. The seat of this disease is in the medullary cavity.

Many authors have confounded this disease with caries. The latter disease, it is true, is often a consequence of the former ; but, in these cases, it is by no means essential to, much less the cause of spina-ventosa. Neither is this a dis-ease of the marrow ; for if the bone were destroyed simply by the compression of that substance, in an enlarged state, we should not find any rarefaction of its structure, but merely a loss of substance.

J. L. Petit and others have confounded this disease with exostosis and caries ; considering them as varieties, or ra-ther as different grades of the same complaint.

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* To prove these assertions it will be sufficient to cite some passages from Avicenna. Ex ger. crem. vers. lib. IV. fen. 5, tr. 1, c. 9, de ventositate spinæ et corruptione ossis :

" Ventositatis spinæ causa sunt humores acuti, penetrantes in os, et corrodentes ipsum."

C. 10, signa corruptionis ossis :

" Cùm ossi accidit corruptio, vides carnem super ipsum mollescere, et mollem fieri, et incipit in via fœtoris et virtus: et penetrat per eam tenta facillimè ad os. Et in-venit rem non firmam in se ipsâ, imò habentem fracturam, aut putrefactionem."

C. 11, Curatio ejus.

" . . . Si corruptio fuerit de illis quas non sanat nisi abscissio, ... scias locum in quo oportet ut incidatur, ita ut revolvatur tenta usquequo consequatur locum in quo invenit adhærentiam ossis ultimam ; quoniam illic est terminis."

C. 12, modus serrandi os corruptum :

" Elevatur caro ab eo osse ita ut ponat in extremitate ejus filum, cum quo tendatur ad superiora. Tene at eam eo incumbrum aut aliud ex illo loco ad inferiora, ut non associentur ei dentes, et serra ipsum . . Quod si partes ossis corrupti fuerint proximæ juncturæ, tunc extrahe ipsum ex junctura, etc. etc."

M. A. Severinus proposed to designate this disease by the term pœdarthoraee. It must be confessed that the prick-ing pain, which the word spina would seem to express, is not always present, and that there is neither air nor lymph in the tumour to justify the use of the adjective ventosa. But the name proposed by Severinus is not less exceptionable, since it is applicable only to one species of the disease that occurs in the feet of children.

There are two distinct species of spina-ventosa. One com-mon among infants, and children before the age of puberty, and affecting the bones of the metacarpus, those of the meta-tarsus, and the phalanges, is a serofulous affection. It com-mences, grows, and subsists a long time, with little or no pain, and often terminates by necrosis of a part of the af-fected bone. The only symptoms which this first kind pre-sents, is a hard, flattened swelling of almost all the affected bone, without sensible alteration of the soft parts, preceded by dull pains, and sometimes even indolent. The motions of the part are not impeded until the tumour becomes large enough to displace the tendons, or to deform the articular sur-faces, which rarely happen. The progress of the disease induces an ulceration of the soft parts, and opposite to which there is an opening into the cavity, enclosed by the bone. A small quantity of ill-digested pus continues to dis-til through the opening for a long time; but the part re-mains indolent, the constitution of the patient does not suf-fer, and, if the patient attain the age of puberty, this spe-cies of spina-ventosa may be cause of partial necrosis, and get well by the efforts of nature alone.

The second kind, happily more rare than the first, is also, more serious. It generally attacks adults, and appears most frequently near the extremities of the humerus, the two bones of the forearm, and especially of the femur and tibia. It is often preceded by acute pain, like that which would be produced by a thorn deep in the limb, and which continues a long time before any tumefaction appears. In some in-stances, however, the tumour is formed with little or no pain. In all cases it occupies the whole circumference of the bone; its hardness and incompressibility evince its bony structure. But it is unequal, and compression excites no pain.

Sometimes the tumour, after having attained twice or thrice the natural size of the bone, remains stationary, giv-ing no inconvenience. But much more commonly, it con-tinues to increase until it acquires a very great size, and be-omes still more unequal than before. Most of the eminen-

ses are bony, but some are less hard ; we do not feel in them
the resistance of a liquid contained within elastic sides, nor
the compressibility of tumours formed of soft parts. This
equivocal sensation leaves us in doubt if these points are less
solid than those which are really osseous. However, the
skin inflames and ulcerates in these parts, purulent matter
is discharged, the tumour increases, the openings remain
fistulous, a probe may be passed through them into the ca-
vity of the bone, the pains are constant and often intolera-
ble, hectic fever gradually steals on, and at length the
patient sinks under it.

We are still ignorant of the structure of the tumours of
which we are treating. Many dried preparations of them
have been preserved, but they teach us nothing of the
change which the marrow has undergone. The bone itself
does not appear to suffer any loss of substance ; but, on the
contrary, an increase. The compact structure of the bone
seems to undergo a singular rarefaction, by means of which
the sides are removed at a great distance from the centre of
the medullary cavity ; so as to form a hollow sphere, inter-
rupted by a great number of round openings, the internal
part of which presents sharp points or eminences. At other
times, on the contrary, the distended sides of the medullary
cylinder, represent a tumour, of which the superficies is
formed by a thick crust, more or less solid, and pierced by
a number of openings; but of which the internal part is fil-
led by a cellular substance, formed by extremely thin bony
plates. In other cases, the medullary cylinder is moderately,
though perceptibly distended; its sides seem to be unequally
removed from the centre of the cavity, so that there are
projections externally, and corresponding cavities on the in-
side, as in the cranium. Lastly, in some circumstances the
tissue of the bone is covered externally by a cartilaginous
mass, which elevates the periosteum, and, in the substance of
which are formed new bony productions, of an irregular and
singular shape, disposed in the manner of radii. A remarka-
ble peculiarity in all these organic changes is, that though
they commence commonly near the extremity of the long
bones, they make very slow progress towards the articular
surfaces, and never reach them ; so that the motion of the limb
is preserved for a long time, while the progress of the dis-
ease seems to remove the end of the bone, and prevent it
from touching the opposite side of the joint.

The bone generally preserves sufficient solidity to support
the weight of the body, and to resist considerable violence:
hence, when the patients are strong enough, and there is no

severe pain, it is not uncommon to see them undergo severe exercises.

Caries of some points sometimes takes place in the internal part of these tumours, or around the edges of some of the openings; but this complication is not common.   It appears to us that the internal part of the tumour is formed by the medullary membrane, diseased and changed either into an reddish substance, like a sarcomatous tumour, or into a yellow substance, like old cheese, or the matter contained in scrofulous tumours.

From what has been said, we see that the formation of these tumours does not admit of any mechanical explanation. The bony structure must be softened at the same time that the medullary membrane is diseased.   But we know not what is the state of the vessels of the limb, or the tumour, nor the chemical changes which the bones or the soft parts have undergone, &c.

The soft parts which surround the spina-ventosa are distended, and rendered thin in proportion to the volume of the tumour.   They afterwards become confounded by inflammation.   However, the muscles preserve a long time the power of contracting, although they are rendered prodigiously thin.

The spina-ventosa which affects the bones of the feet and hands of young persons always arises from serofula.   It follows the same course with the other symptoms of that disease, is cured spontaneously under the same circumstances, &c.

The spina-ventosa which affects adults is often accompanied or preceded by symptoms of scrofula.   Syphilis has been considered capable of causing the disease, but mercury will not cure it as it does exostosis which arises from this cause.   We know not how far psora, rheumatism, herpes, the cure of old ulcers, the crisis of internal diseases, and, above all, external violence, may be considered as causes of spina-ventosa.

As to the diagnosis of this disease, we can add little to what we have said in giving its history.   Although it differs from exostosis, in that the latter is circumscribed and confined to a part of the circumference of a bone, while the former extends all around it; yet they may be confounded on account of the inequalities which spina-ventosa presents from the commencement, and because the thickness of the soft parts prevents us from judging of the extent and form of the tumour.   Osteo-sarcoma may, also, be easily confounded with spina-ventosa, even in its advanced stage; but the former, though slow in its progress, is acute when compared with the latter; it reaches its fatal end in much less time.

and is always attended with pains much more acute and constant.

The spina-ventosa which affects children progresses slowly, does not impair the constitution, and is often cured spontaneously : that of adults is seldom accompanied with dangerous symptoms in the commencement ; it continues a long time without causing great pain. and becomes dangerous only when ulceration has taken place. As amputation is the only resource, the danger is greater or less according as the disease is more or less near the trunk.

In the treatment of this disease Boerhaave proposed sudorifics, spirituous fumigations, conducted under the bed-clothes by means of a tube, purgatives from time to time, &c. But this treatment is not successful.

Some authors advise that the spina-ventosa should be laid bare from its origin ; its sides opened with a trepan, and a large hole made into its cavity. which is then to be filled with tincture of myrrh, aloes, or even cauterized with a hot iron. But this treatment is perfectly useless in spina-ventosa : it has obtained its reputation from its application to other affections. As to the actual cautery, in order to derive any advantage from it, it would be necessary to destroy the whole thickness of the bone, which, judging from the result of similar operations made upon animals, would probably prove fatal. Indeed we know of no means of curing spina-ventosa. While the disease does not affect the constitution, we can only palliate it by sedative applications ; such as fomentations, with a decoction of the leaves of night-shade, [solanum dulcimara] of hyosciamus, the heads of white poppy, &c. to which may be added a proportion of opium.

However urgent the symptoms of ulceration may appear in certain parts of the tumour, they should never be opened ; for the distention of the soft parts does not arise from the presence of pus, the tumour is not diminished after it is discharged, but, on the contrary, hectic symptoms supervene, which art cannot repress ; every thing, therefore, should be left to nature.

When the patient is sinking under colliquative symptoms, and even before this period, if the tumour be likely to reach the trunk, amputation of the limb should be performed. But where spina-ventosa affects one of the bones of the hand, and the patient has not attained the age of puberty, and particularly, if, at the same time, he have other symptoms of scrofula, we should not recommend an operation, since nature often effects a cure. In this case we may second her efforts by the treatment required for scrofula.

ARTICLE IV.

Of Osteo-Sarcoma.

We understand by the term osteo-sarcoma, a disease of
the bony tissue, in which, after having experienced more
or less distention, the substance of the bone becomes dege-
nerated, and undergoes various changes, analagous to those
of the soft parts in cancer; while the local and general
symptoms present a still more striking resemblance to those
of the latter disease.

Various diseases have been described under this name, and
particularly that in which osteo-sarcoma is complicated with
spina-ventosa, and other affections of the bones.

All the bones are subject to this disease, but it is observed
most frequently in the bones of the face, those of the base
of the cranium, the long bones of the extremities, and,
above all, the os innominatum, which, of all the bones in
the body, is most frequently affected with it.

In observing attentively the developement of osteo-sar-
coma, we may see that there are two distinct species of this
disease, identical in their nature, but differing in the order
of parts which they affect. In one, osteo-sarcoma is the
effect of the successive progress, by continuity of cancer of
the adjacent soft parts; as we observe, for instance, in the
bones of the nasal fossa, and particularly in the upper jaw,
in consequence of a hard and cancerous polypus, which has
existed for a very long time, isolated, and without any other
local affection. In the second species, the bone is the pri-
mitive seat of the disease: its proper tissue becomes dege-
rated, and the surrounding soft parts become diseased se-
condarily.

In all cases, osteo-sarcoma commences with severe, acute,
deep-seated pain, which continues a long time before any tu-
mefaction appears. These pains sometimes are aggravated,
and attended with a sensation of shooting, and the constitu-
tion becomes impaired before any change in the form of the
affected limb takes place. Tumefaction then comes on. It
extends around the limb; its depth and hardness indicate its
nature and its seat; it is unequal and knotted; compression
does not diminish it, nor increase the pain, and the soft
parts are still in their natural state. The tumour increases
with more or less rapidity, and with it the pains, which al-
ways continue to be of the shooting kind. The soft parts,
distended and affected by the progress of the disease, swell

and become the seat of shooting pains. Sometimes the skin inflames and ulcerates, and, in this case, which is extremely rare, the sore assumes a cancerous aspect. Slow fever takes place; the violence of the pain, scarcely abated for a moment by opium, gradually exhausts the patient.

Sometimes the disease, having commenced with extremely violent pains, seems to relax, and even to suspend its progress for a long time: but most commonly the disease continues to make rapid progress, and, in a few months, the patient's situation is often eminently dangerous.

When the disease has existed for a long time, we commonly find the tissue of the bone more or less destroyed, and its place occupied by a homogeneous, greyish-yellow, lardaceous substance, which cuts smoothly, like the white of a hard boiled egg, and of which the consistence varies from that of cartilage to that of thick broth.

The adjacent soft parts participate in the same change. Muscles, tendons, periosteum, ligaments, vessels, cellular tissue—all are confounded in one homogeneous mass. In some cases we find cavities, containing a fetid ichor, or a substance like beef-tea; and sometimes in the centre of the lardaceous substance, into which the bone is transformed, we find a semi-transparent gelatinous substance.

Syphilis, scrofula, psora, herpes, rheumatism, and even external violence, have been named as the causes of osteosarcoma. They may be combined with it—they may have more or less influence in favouring its developement, but we cannot believe it capable of producing so serious a disease. It is extremely probable that osteo-sarcoma results from the action of the cancerous virus upon the bones. The disease is almost always reproduced, after amputation, in the same manner as cancer of soft parts.

The efforts of nature are never capable of curing this disease, or suspending its progress. Amputation is the only resource; and were this operation performed at a very early period, it is probable that a relapse would at least be delayed for a long time. But the disease is too difficult to be recognized in the beginning, and surgeons seldom propose, or patients submit to amputation, before the progress of the disease renders death inevitable.

All that we have said in relation to cancer is strictly applicable to osteo-sarcoma.

We shall conclude this article with one or two observations upon a disease which has no analogy to organic affections of the bones, but which has been described as an affection of

the periosteum, and of which we have had no other occasion
to speak.

Under the name of fungous, lymphatic tumours of the pe-
riosteum, authors have described true cancerous tumours of
the cellular tissue, developed near a bone, and destroying
the bone by pressure, without any change in the osseous tis-
sue, and without residue, as takes place about fungous tu-
mours of the dura mater, in aneurisms in the sides of the
maxillary sinus, when tumours are growing within it, &c.
These tumours commence with very acute pains, and are ex-
quisitely tender to the touch. At first they have no connexion
with the bone, but afterwards appear united to it.   How-
ever, upon close examination, we find them only lodged in
the excavations formed in the bone. Afterwards the skin
inflames and ulcerates, and the tumour presents, in every
respect, all the characteristics of cancer, partaking also
of its incurability. The circumstance of these tumours form-
ing in the neighbourhood of bones, and in that part of their
surface which is least thickly covered with soft parts, arises
from some unknown cause, which time may, perhaps, ex-
plain.

We shall here relate an interesting case of complication
of spina-ventosa, with osteo-sarcoma, and an hereditary
disposition of these two diseases.

Victoria M. Pelerin, aged thirty years, was born in Paris,
of strong and healthy parents. Her father is of middling
stature; his skin is brown, and his hair black; his san-
quineous vessels are very much developed, and his tempera-
ment partakes of the sanguine and bilious. He has always
enjoyed good health, and is still very strong.

The brothers and sisters of the patient are tall, well made,
and robust; most of them are married, and have healthy
children.

The patient herself is of a moderate and slender stature,
but of regular proportions. Her expression is agreeable,
her skin brown, her hair, eye-brows, and eyes, of a bright
chesnut; her constitution is strong, and her temperament
bilious and sanguine. She has always lived in honest ease,
and in a healthy part of Paris. Her health has ever been
good. She has had six children, which she nursed herself, and
of which four are now living. The two which she has lost
died in early infancy, of acute diseases. Of the four who re-
main, three are healthy and robust; the eldest girl, aged se-
ven years, is large enough for her age, but her limbs are of
a very moderate size. She has been sick a long time, in

consequence of repeated attacks of intermittent fever, and her convalescence has been lingering and tedious. Her character is morose and capricious, but the expression of her countenance offers no indication of scrofulous disposition.

The father, brothers, sisters, nephews, and children of V. Pelerin have had, since their earliest infancy, bony tubercles, with a narrow base, and conical on the external side of the middle of the tibia, or on the upper part of the internal side. These tumours are indolent, and have made no progress for a very long time.

The patient herself has had similar tubercles on the superior part of the anterior side of the left humerus, the superior part of the inner side of the right tibia, and on the inferior and anterior part of the left tibia.

Since her youth, one of these tubercles has grown on the middle of the left femur. It soon assumed the form of an ellipsis, that extended quite around the bone; being three inches in breadth, and four inches in its largest diameter. Its growth has been attended with severe pain; its cause was not known, and for several years it has been indolent and stationary.

When very young the patient felt obtuse pains a little below the middle of the left thigh. A tumour soon formed in this spot, which made slow progress during her youth. Puberty neither accelerated nor retarded its growth.

At the age of nineteen, at which time she was married, this last tumour was as large as a man's fist, but completely indolent. It continued to increase with the same slowness for the eight years following. While she nursed her first child, and especially after she weaned it, the tumour made much more rapid progress. It was then as large as the head of an infant. At this period severe pains came on at intervals, which obliged the patient to keep her bed for several weeks.

Some persons persuaded the patient's husband that the weaning of the child was the cause of this disease, and that a new pregnancy would cure it. She became pregnant, but the tumour increased with still greater rapidity, and was attended with pain, sometimes insufferable. Two months after the birth of the child, which the patient undertook to suckle, the pains were so severe as to cause a symptomatic fever of several days duration, and the skin was strongly distended, and threatened with inflammation in some points. Rest, diet, the use of opium internally, and sedative applications, calmed

this storm. The patient then weaned her child, and entered the hospital Charité the 24th of May, 1810.

The tumour at this time extended from the middle of the thigh to the knee, inclusively. Below the condyles of the tibia we could distinguish the tension of the inferior ligament of the patella, and this bone itself in front of the tumour, and in a manner burried in it. Some movements of the knee could yet be performed. The leg was habitually in a state of moderate flexion. Walking gave no pain, and, six weeks before, the patient had walked five miles on foot over the pavement of Paris. The tumour resembled a sphere presenting, in its circumference, several large conical projections, with a large base. Its consistence appeared to be that of bone. Some of the more projecting points were compressible, and very elastic. The skin which covered the tumour was strongly distended, and dilated veins were running over it. It was red only in some points, corresponding to those on which the tumour habitually rested. The circumference of its centre was thirty-three inches; that of the thigh immediately above the tumour, eleven inches and a quarter; that of the knee below the tumour, fifteen inches; the diameter from the fore to the back part eleven inches; the transverse diameter nine inches and a half. The pain had nearly subsided, and the fever had disappeared a short time before. In other respects the patient was well enough. Rest and sedative applications were prescribed.

May 27. The pains almost gone. The patient is directed to take the purgative whey of Weiss.

June 5. The same medicine repeated.

In the course of the month the pains returned, but the patient continued free from fever. Movements of the limb did not increase her suffering, and she could walk from the hospital to her home, a distance of two miles, and back again. She could even stamp her foot strongly on the ground without pain.

Towards the end of the month the tumour had made sensible progress. There was fear lest it should grow upwards, and thus deprive us of the power of amputating of the thigh, the only resource in case the tumour assumed a dangerous aspect. The patient consented to the operation, which was performed on the 4th of July. There was some little difficulty in performing it, on account of the tension and elevation of the muscles caused by the tumour; and a considerable loss of blood took place from the arteries not being perfectly compressed.

Plate 5

J. Mater sculp

PLATE V.

The Tumour deprived of Muscles, and of the Envelope furnished by the Periosteum.

a a a. The circumference of the tumour.
b. A portion of the body of the femur.
c. A depression corresponding to the tendon of the extensor muscles of the leg.
d. A groove corresponding to the linea aspera.
e. The external division of this groove, which follows the external branch of the bifircation of the linea aspera, and lodges the corresponding portion of the fascia lata.
t h. Bony tubercles formed upon the tibia.

PLATE VI.

Half of the same Tumour after Maceration,

a. A part of the body of the femur.
b b b b b b. Radiated spiculæ of bone, proceeding from the cartilaginous mass.
c. The external branch of the bifircation of the linea aspera, forming a sharp crest.
d d. Intervals left by the separation of insulated portions of bone during maceration.
e. The external condyle of the femur

Plate 6

J. Milbert sculp

The weight of the limb immediately after it was re-
moved was thirty-nine pounds.

A model in plaster was made, which is now deposited in
the Museum of the Faculty of Medicine, and on the fol-
lowing day it was dissected.

The triceps cruralis, the rectus and sartorius were thin-
ned, spread out, and presented a yellowish hue, they form-
ed a sort of membrane, which enveloped the tumour. The
muscles of the posterior and internal sides of the thigh were
natural; the femoral and the popliteal arteries were raised
and distended lengthwise, but of the natural diameter, and
without organic alteration; they passed obliquely from the
middle and internal part of the thigh to the lowest part of
the ham, winding on the internal part of the tumour, which
had flattened them. The sciatic nerve, and its two branches,
were pushed back, distended and flattened. The patella,
and its inferior ligament, were in its natural state, except
that the posterior surface of the bone presented slight de-
pressions, and the articular cartilage was thinned in some
spots, corresponding to projections on the surface of the tu-
mour; but it still retained its natural polish.

Having removed the muscles, we found that the tumour
was formed of an almost spherical mass, of the colour
of pearl, elastic, semi-transparent, easily penetrated, even
with the nails, and not running, although it looked like
jelly.* Its form was not unlike a very large potatoe, com-
posed of four principal lobes, and subdivided by an infinite
number of little lobules; a large furrow passed along the
anterior surface of the tumour in the situation of the com-
mon tendon of the triceps and rectus anterior. Two other
narrow, but very deep furrows passed first parallelly along
the posterior surface, and afterwards diverged; one pass-
ing downwards and inwards, and the other downwards and
outwards, in the course of the two edges of the linea aspera.

The periosteum, thickened, rendered more consistent,
and giving attachment to fleshy fibres, was plainly discover-
able on the outside of this mass. It passed directly from
one lobule to the other, and sent off to the bottom of each
furrow a process of hard fibro-cellular substance, which
was easily detached from the tumour, but was torn out with
great difficulty. This disposition of the periosteum resem-
bled very strongly that of the pia mater, with the tunica

* See the plates 4, 5, 6, and the model deposited in the Museum of the
Faculty of Paris, No. 96

arachnoides, and the connexion of these membranes with the surface of the brain.

The membranous covering of the tumour being carefully removed, the mass that was brought to view resembled cartilage, yet soft and granular, and, on cutting deeply into it, we discovered numerous isolated spiculæ, parallel to each other, and resembling osseous filaments, incompletely organized, and partially solid.

The point of a scalpel plunged into this mass, encountered, at a certain depth, a bony substance, into which it stuck.

The femur above the tumour was natural. A probe which was passed into the medullary cavity, was somewhat moveable, after it reached the middle of the tumour.

The ligaments of the knee joint were natural. The synoviale membrane, especially in front of the crucial ligaments, was injected, thickened, and hard.

The muscles of the leg were of the natural colour and consistence, and larger than those of the opposite limb.

At the two extremities of the tibia and fibula, on their anterior and posterior sides, were several excrescences of a conical shape, formed of a thin shell of bone, containing a substance like that of the principal tumour.

The lower half of the femur, with the tumour and the two bones of the leg, completely stripped of soft parts, weighed twenty-one pounds.*

A point of fetid serum oozed from the tumour during the forty-eight hours it was left with the modeller.

The femur being sawed longitudinally through the condyles, was found to have retained its natural form and consistence to one third of the height of the tumour by which it was merely surrounded. The condyles presented a very thin and fine net-work, with much larger cavities than natural. In the interval between these two portions, and to an extent of about one eighth of the length of the bone, the sides of the bony cylinder were removed from its axis, and the lamellæ of the compact structure were separated, diverging inwards and outwards, then changed to filaments more or less fine: thus converting this substance into an oreolar tissue. There were apertures in the sides of the tumour like those of a gun-barrel that has bursted. The medullary

* Considerable weight must have been lost by evaporation during the time employed in modelling and making a drawing of the tumour, of which no account could be taken.

tissue was not diseased, and the cells were not filled with pus or fungus ; nor was there any appearance of caries.

From the circumference of this diseased part of the femur, spiculæ of bone passed like radii towards the periphery of the tumour, divided and sub-divided into an infinite number of ramifications, confounded with one another. The structure of the net-work was proved, by maceration, to be entirely different from that of the sides of the medullary cylinder, in which the primitive texture of the bone might be perceived. Some parts of the exterior net-work were entirely unconnected with the bone.

The greatest part of the tumour was formed of the cartilaginous substance of which we have spoken. It filled the intervals in the periphery, between the external net-work. In several points it was changed, softened, and red, and appeared to the eye like gooseberry jelly ; in other parts were seen cavities filled with bloody matter. In the posterior part were several other cavities, as large as a nut, with irregular, greyish, or yellowish sides, containing a yellowish fetid ichor, and in every respect like cancerous abscesses. These cavities were distant from the primitive bone, and unconnected with the external bony net-work.

Nothing remarkable followed the operation. At the present time (October 2d, 1810) the cicatrix is complete; the patient enjoys good health, and the bony tumours which remain are not painful, and have not increased in volume.

Although the following case is not so interesting as the preceding, because it relates only to the dissection of the diseased part, it is important, inasmuch as it gives an idea of the changes which take place when caries is complicated with osteo-sarcoma, or when the latter exists without the former.

It relates to a tumour formed in the haunch and in the sacrum, which destroyed the patient by inducing a marasmus similar to that caused by cancerous affections.

The tumour extended from the region of the sacrum to the anterior and internal part of the thigh. It raised and had thinned the glutæi muscles and the fascia lata. It pushed in the colon, the bladder, and the iliac muscle.

It included the sacrum, the inferior part of the os ilium, the horizontal branch of the pubis, and the ischium to its tuberosity. This last, and the body of the pubis were preserved, moveable, and as if separated from the rest by the difference of their structure, and that of the diseased parts, with which they were in continuity.

The tumour weighed eleven pounds and a quarter. Its

structure was that of a fine bony net-work, which appeared to be entirely wanting in certain parts, and of which the meshes were filled by a substance partly red and of a fleshy appearance; partly white, or greyish, and of a lardaceous appearance. It enclosed several spaces, some filled with bloody matter, others with a yellowish fetid ichor. The sacro-iliac surface of the sacrum of the diseased side was carious.

CHAPTER XXII.

Of the Softening and of the Fragility of the Bones.

IT seems natural to consider these as two distinct affections. A few facts seem to favour this opinion, and the doctrines to which chemistry has given birth appear to support it. But the chemists have not yet satisfactorily ascertained the different proportions of the solidifying matter in diseased bones; a great number of facts prove that the bones of the same person, or even different parts of the same bone may be both softened and rendered friable at the same time; and, lastly, the bones of patients, whose bones have been observed to be fragile during life, have not been proved to contain an unusual proportion of earthy matter. Indeed, there is reason to think that the highest degree of the cancerous diathesis may render the bones friable. Perhaps the same is true of syphilis. These facts make us lament the want of anatomical and of chemical examinations of bones thus diseased. The want of such examinations is felt the more sensibly since many unsuspected fractures, evidently of long standing, have been discovered after death, in persons whose bones were believed to be softened; and, in similar cases, the bones of subjects, in dissecting rooms, have been broken by a force which would not have had this effect in any other circumstances. We can only point out this chasm in science, and invite the attention of practitioners to this subject.

It may be inferred from what we have said, that there is hardly a case of simple softening of the bones: almost in every instance they have been found, at the same time, deprived of their solidity and of their elasticity, or, in other words, of the attraction of cohesion of their particles. We shall, therefore, now consider the bones as affected with this double and singular disease.

The term rachitis, or rakitis, has been applied to that affection of the bony system in which the organs of which it is composed are deprived of their ordinary solidity, and in which the spine, and the long bones of the limbs, suffer various deformities, with or without fractures, produced by very slight causes.

This disease generally occurs from the age of six months to four years. Children have been born with it. Young persons, and even adults and old persons have been known to be affected with it. But these last named cases are very rare.

Persons of a lymphatic and nervous temperament, of a weak constitution, and those who receive from their parents, or acquire a scrofulous diathesis, are most disposed to rickets; yet some children, apparently of strong constitutions, and born of healthy parents, become affected with this disease.

The exciting causes of rickets are a previous illness of long duration, intermittent fevers, living in a moist or low situation, an unwholesome nourishment, an improper physical education, too long suckling, the repercussion, a disease termed crusta lactea, of tinea, herpes, &c. the presence of worms, a painful dentition, especially if accompanied with convulsions, &c.

We cannot consider scrofula as the cause of rickets in every instance, for this reason, that if this were admitted we should also have to allow that this disease of the bones constitutes the highest grade of scrofula, which has never been proved. Rickets has been thought a syphilitic disease ; but we rarely find it following that malady ; neither is it proved that rickets is a gouty or rheumatic affection, although the softening of the bones is generally preceded by deep-seated, acute, and obstinate pain, like those which occur in these diseases.

A disease which always presents the same phenomena cannot arise from different causes. This would be a deviation from the ordinary laws of nature. It appears probable that rickets arises from an unknown specific cause, which acts upon the whole system, of which the softening of the bones is only one symptom; and that the scrofulous, syphilitic, or any other disposition with which it may be combined, can favour the developement of rickets, only by the debility it induces ; but that neither of these diseases is the essential cause of that disease. It is hardly necessary to refute the opinion of the chemists, that rickets arises from the spontaneous formation of oxalic acid. It is entirely hypothetical.

When a child is affected with rickets it becomes sad and grave; it ceases to love its usual play; exercise is painful; it wishes to be always lying down, sitting, or carried by its nurse. At this time the ends of the long bones become swollen, and the enlargement of the joints is the more striking, on account of the thinness of the limbs.

This first degree of the disease is characterized, in adult subjects, by pains, more or less acute, wandering or fixed, and of an equivocal kind. Exercise is at first painful, afterwards impossible.

When the swelling of the joints has become apparent in children, an increase of the size of the head is also perceived. At the same time their imagination and judgment acquire an astonishing power and maturity, and the expression of the face is indicative of genius.* But when the disease takes place at a more advanced age, the sutures of the cranium are obliterated, the head cannot increase in size, and the patient becomes stupid.

As the disease advances, and sometimes even from the commencement, the liver becomes more voluminous, and the abdomen is tumefied;† the face is covered with wrinkles, and the cheeks, hanging in a fold, form a sort of tumour near the angles of the lower jaw; dentition takes place slowly; the teeth, when they first appear through the gums, are black and diseased, and soon become carious.

Commonly the first state of the disease is accompanied with an irregular chronic fever; the sleep is disturbed, and the appetite deranged; the stools are scanty and discoloured, and a copious flow of urine occurs, sometimes limpid, at other times thick, and containing a whitish sediment.

Pains in the region of the spine soon announce that a deformity is taking place in this part. The spine bends in various directions, but always in curved lines, and never at an angle; the ribs of the breast become flattened and depressed, and the sternum projects forward like the breast of a fowl, or the prow of a vessel. The long bones soon become bent in the direction of their natural curves.

At this advanced period of the disease convulsions, epilepsy, vomiting, strangury, transient blindness, and deafness, and other nervous symptoms, are often observed. Buch-

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* Glisson (de Rachitide) expresses himself in these terms :—" Vultum videre est, magis compositum et severum, quàm ætas postularet, ut si in rem seriam aliquam meditabundi essent."

† Glisson has perfectly depicted this symptom :—" Abdomen exteriùs quidem, respectu nempe partium continentium, macrum est; interiùs verò, respectu partium, contentarum, nonnihil promit præ se turgidiusculum sentitur."

ner remarks, that of eleven brothers, the greater part of whom died rickety, those who were exempt from this malady, suffered serious convulsive diseases, and died in early childhood.

The highest grade of rickets sometimes is cured spontaneously by the progress of age, or some other natural cause. In this case the pains cease, the fever disappears, the belly subsides, and resumes its natural size and consistency ; the appetite returns, and the digestive functions are restored ; the bones recover their solidity in a deformed state ; the strength is re-established ; and the muscles, although rendered extremely thin, acquire energy enough to execute the movements necessary for standing and walking, but with more or less difficulty. The head retains its preternatural size ; and it is observed, that the patients who have this disease in their childhood, retain, throughout life, the vivacity which characterizes the first stage of rickets.

But when the disease is about to terminate fatally, the pains continue ; the deformity of the chest causes more or less difficulty of breathing ; the patient is attacked with hemopthisis, once or oftener, and even phthisis pulmonaris, which has been unjustly attributed to the mechanical obstruction to respiration. The muscles diminish in size, and they remain in a state of permanent contraction, which keeps the limbs constantly flexed, or in singular and odd positions. The nails grow longer, become soft, bent, and altered in their structure. The patient is in a manner fastened to his bed, by reason of the severe pains which the slightest motion occasions. Most commonly in moving him one or more bones are broken ;* at length slow fever, diarrhœa, and marasmus put an end to the patient's existence ; sometimes, however, he dies in convulsions before these symptoms occur.

When we find, upon dissection, that the brain is enlarged, but not otherwise changed, occasionally there is a collection of serum in the ventricles.† The lungs are often found filled with tubercles, even when there is no symptom of phthisis pulmonaris. The glands of the mesentery are swollen, tuberculous, sometimes even containing collections of steatomatous matter ; but when the disease has passed through its periods slowly, these organs are found in their

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* It is certain, and yet very remarkable, that these solutions of continuity are capable of re-union, notwithstanding the great change in them which is caused by the disease.

† It is probable that this symptom of rickets has often been mistaken for ideopathic hydrocephalus ; for when the symptom appears early, the pati ent dies before any of the other phenomena of rickets are apparent

natural state. The liver is voluminous, the intestines and
bladder distended and relaxed; the muscles are thin, pale,
and yellowish; the bones are light, and of a red and
brown colour; a large number of dilated blood vessels
pass into them; they are porous, spongy, soft, and com-
pressible; they are moistened with a sort of sanies, which
may be pressed out as from tanned leather after it has been
macerated. The sides of the medullary cylinders of the
long bones are very thin, while the bones of the cranium
are thicker than natural, and more spongy. All the bones
are remarkable supple, but when bent beyond a certain de-
gree they break, especially if bent suddenly. The medul-
lary cavity of the long bones contains a reddish serum,
very different from that of marrow.*

Few chemical experiments have been made on rickety
bones. All we have learnt from them is, that they contain a
smaller portion of alkaline, or earthy salts : but this change
is much less than has been believed, and the parenchyma is
altered so much that it is completely dissolved by a mineral
acid. It cannot be doubted that in the living parenchyma of
the bones the principal seat of rickets exists. Those who
have merely considered this disease as arising from a want
of earthy salts, have regarded only its last symptom. How
idle, therefore, is it to administer the phosphate of lime to
rickety patients! All we know of the etiology of rickets is,
that, when the bones are once softened, the weight of the
body, the action of the muscles, and probably other un-
known causes, produce the multiplied curvatures of the
bones: for we cannot attribute to any known causes the cur-
vatures of the spine, which take place in patients who are
kept in a horizontal position from the commencement of the
disease.

The earlier rickets appears, the more serious it is. Acute
diseases, especially eruptive fevers, when they affect rickety
children, suspend the progress of the disease. An acute fe-
ver, at first apparently symptomatic, but which afterwards
assumes a regular and acute form, and even an eruption
without fever, have been known to cure the disease. The
crisis of puberty has not so much influence over rickets as
scrofula, though it has, in some instances, produced an
happy effect. Rickets frequently suspends its progress dur-

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* Many of the organic affections we have enumerated as following rickets,
are evidently foreign to this disease. The number of them is, perhaps, more
considerable than it appears. The study of morbid anatomy, a science
almost new, and which we cannot too strongly recommend, can alone
elucidate this subject.

ing spring and summer, and acquires fresh vigour in au-
tumn and winter. Sometimes the disease remains stationary
for a number of years, without any known cause. The com-
plication of scrofula, syphilis, or scurvy, is always very
dangerous. Convulsions, permanent spasms of the muscles,
fractures, hectic fever, marasmus, &c. are, for the most
part, fatal symptoms. When rickets attacks adults or aged
persons, it is generally mortal. We do not believe that the
muscles are ever capable of restoring to rickety bones their
natural form, as certain writers have advanced.

If we examine the treatment that has been proposed for
rickets, we find it consists in the employment of various
means for the cure of those diseases with which this may be
combined. Preparations of mercury, antimony, iron, al-
kalies, sulphur, &c. have equally succeeded in cases to
which they were suited; but we believe there is no exclusive
or specific treatment of rickets. Tonics are generally ser-
viceable; but we think that many cases of rickets have
spontaneously come to a happy termination during the use
of inefficient remedies.

It is proper to advise a change of air, a transition to
high, warm, and dry situations; the use of nourishing ani-
mal food, and of generous wine; dry frictions, with aroma-
tic substances over the whole body; tonics of every kind,
among which we may enumerate the mercurial salts, the sul-
phurets, the oxydes or antimonial salts, sulphur, and sulphur-
ous water: the various preparations of bark may often be
employed with advantage.

These remedies must be administered with prudence and
discrimination. There are three states of the disease. The
first is characterized by great irritability, severe pain, want
of sleep, and acute fever. This state may return at various
periods of the disease, and sometimes leads to an happy
termination. Sedatives are here proper, and any stimulat-
ing remedy is dangerous, at least until the calm takes place,
which always succeeds this agitation of the system.

This calm constitutes the second state of the disease;
during which it appears to suspend its progress. It is in
these intervals of pain and suffering that the efforts of na-
ture towards a cure take place,* and this is the time to ad-
minister our remedies.

The third state of the disease is that of marasmus and

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* The distinction of these first two states of the disease is due to Pujol,
a modest and enlightened physician, whose writings are worthy of being
studied.

diarrhœa.   Active remedies can then be of no service, and
they are generally improper on account of great debility
and extreme excitability of the system.   It is necessary to
combine almost all exciting remedies with opium, and to
use them in very small doses.

As to the use of corsets, crosses, and other machinery,
enlightened practitioners of the present day have renounced
them ; and it is generally agreed that it is proper to leave to
nature alone, aided by internal treatment, the task of
straightening bones deformed by rickets.

CHAPTER XXIII.

Of Sprains.

A Sprain is the result of a violent movement, in which the
joint has been wrenched, without the bones that com-
pose it having suffered any sensible movement.   The move-
ments of the joints cannot be carried beyond their natural
limits without straining or breaking the ligaments which
unite the bones.   Thus a sprain is always accompanied by
the first of these circumstances, which is proper to it, and
sometimes by the second.

The term *diastasis* is applied to the lateral separation of
two long bones, joined with each other by the sides, corre-
sponding to their extremities, and particularly to injuries of
this nature, which affect the fixed joints ; such as those of
the tibia with the fibula, and those of the bones of the pelvis
with each other.   But all these circumstances equally take
place in sprains.

The spherical joints, those that permit the most varied and
extensive movements of the bones, are disposed in such a
manner that their ligaments, protected by a great number
of strong muscles, cannot suffer any considerable extension
but by great violence ; and the displacement which necessa-
rily follows must be permanent, by reason of the round
form of one of the surfaces of the joints ; a form that can-
not permit a spontaneous re-insertion.

In the ginglymoid joints, on the contrary, and in those
that resemble them in the small extent of their movements,
the natural union of the bones is secured by the dispositions
of the joints, and by the strength of the ligaments, but very

little by the muscles; so that the action of these last or-
gans cannot add much to the resistance made by the former:
hence the force which tends to separate these bones is usu-
ally confined to the extension or breaking of the ligaments.
The joints of the foot that unites in the highest degree, the
circumstances of which we have been speaking, and which
is, besides, exposed to frequent and considerable violence,
is that in which sprains are most frequently observed. The
joints of the tarsus, of the carpus, of the wrist, knee, and
elbow are less frequently sprained, although they possess the
proper structure; because the ligaments that fix them being
very strong, the force required would be sufficient to pro-
duce luxation.

To produce a sprain, it is necessary that the violence which
caused it should have carried the ginglymoid joint beyond
its natural limits, or forced it in an unnatural direction, or
have caused a movement in a joint that naturally does not
permit of one. Thus, in falls on the head, where the ex-
tensor muscles of the wrist are acted on, a sprain very rea-
dily ensues; falls on the feet, when one of them is turned
inward or outward, and supports the whole weight of the
body; a sudden fall backwards, when the point of the foot
is caught in such a way as to prevent the leg from being
drawn backwards; in quick walking, when the sole of the
foot rests on an inclined plane, and is turned inwards: in all
these cases a sprain of the ankle, or of the bones of the tar-
sus, or both, will be occasioned.

With respect to the joints of the foot we observe, that a
predisposition to scrofulous affections renders persons more
liable to sprains; for when the articular extremities of the
long bones have been swelled in early age, the ligaments of
the neighbouring joints are lengthened or relaxed. This
phenomenon, particularly remarkable at the inferior extre-
mity of the leg, flattens the foot; the joint becomes looser
and feebler than in its natural state, and persons thus affected
are most exposed to sprains: it is not uncommon for them
to experience the same accident repeatedly in the same joint.
As to the kind of injury designated under the term diastasis,
it is not easy to see how it can take place without a fracture
of one of the two bones: taking, for example, the bones
of the leg, it is difficult to conceive that the inferior arti-
culating surfaces of the tibia with the fibula should be se-
parated by any extreme violence, or that their ligaments
stretched or broke without a fracture of the fibula. It ap-
pears to us very difficult to prove that there is any such injury
as that termed diastasis; because the swelling that immedi-

ately takes place prevents an examination of the parts.
Many cases of fractures of the fibula have been mistaken
and adduced as proofs of cases of diastasis.

Sprains are immediately followed by pain and swelling.
The violence done to the ligaments and other soft parts
around the joints, causes the former. Pain and irritation
attract the humours to the part affected, and produce the
swelling. This is small at first, but it soon augments;
and, at the end of twenty-four hours, it is usually great, and
attended with inflammation. The blood that escapes from
the small broken vessels flows into cellular tissue, and pro-
duces an ecchymosis, which frequently extends very far.
Immediately after the accident the joint can perform its or-
dinary movements, but as soon as the swelling takes place it
has no further action; and if then the parts are moved, great
pain is caused, and the disease is aggravated.

When the pain is slight, a sprain is of little conse-
quence, and can be easily cured. The pain decreases gra-
dually, the swelling and tension dissipate, the ecchymosis
disappears, power and motion are restored and become more
extensive daily, and the joint soon resumes its natural state.
But when a sprain takes place in one of the joints very
closely formed, strengthened by very strong ligaments, whose
resistance cannot be overcome but by violent efforts, the
accident then becomes serious, and is longer in being cured;
and, according as the ligaments have more or less suffered,
and the tumefaction in the soft and delicate parts is more
or less considerable, the joint becomes very liable to a re-
petition of the same accident, or, in other cases, contracts a
stiffness that renders its movements very difficult, and which
is not dissipated until after a length of time, and frequently
exists during life.

In persons well formed and exempt from any internal dis-
order, sprains have rarely any other effect than those already
mentioned; yet an improper manner of treating them, and
particularly the imprudence of the patient in using the part
before the pains have ceased, may render a sprain very seri-
ous in persons otherwise healthy. After the pain and swel-
ling have diminished, they return with their former violence;
so that a patient who ought to have been well in five or six
weeks, frequently suffers five or six months, and sometimes a
whole year. In other cases the symptoms augment instead
of decreasing, and the pain and swelling arrive at the high-
est degree; suppuration takes place; the bones become ca-
rious, and amputation is rendered necessary to preserve the
life of the patient.

But these very serious accidents, the effect of sprains, are seldom observed, except in persons who have some internal or general disorder that affects the joints. The most common and most alarming is scrofula. In patients thus affected, a sprain is frequently the occasional cause of white swellings of the joints, the progress of which may differ more or less from the chronic state that is proper to tumours of this kind, and may render amputation necessary.

The signs of sprains are very easily understood: an external violence, the nature and feeling of which are always known; pain, more or less violent, in the affected joint, without deformity or manifest alteration in the natural relations of the surfaces of the joints; the liberty of movement directly after the accident; an immediate swelling, proportioned to the violence of the effort—such are the phenomena that characterize these accidents.

A slight sprain is an accident of little importance, and is cured in a few weeks, if properly treated, and the patient do not move the part until the pain and swelling are entirely dissipated. A violent sprain in a joint closely formed, and supported by very strong ligaments, as, for example, the foot, is a serious accident : it frequently lasts several months, and may be attended with serious consequences, from improper treatment, and particularly from imprudence in the patient. A slight sprain in persons disposed to scrofula, is always a serious accident, as it may occasion a white swelling.

The treatment of sprain consists in preventing swelling and inflammation, diminishing them should they have taken place, facilitating the re-union of the broken ligaments, and restoring the strength and movement of the joint.

Cold water is the best remedy that can be employed to fulfil the first indication ; it prevents the afflux of humours, and keeps down swelling and inflammation. It is rendered more efficacious by adding a certain quantity of liquid acetite of lead. Thus, if called the moment a sprain has taken place, plunge the part in a bucket of well-water, adding thereto at the rate of half an ounce of extract of saturn to each pint of water. The part affected should remain in the water several hours together, and, as the water becomes warm, it should be renewed. It is easy to conceive that this treatment would be dangerous to a woman that had, or was on the point of having her menses ; to persons of weak breasts ; and to such as are subject to hæmoptysis ; those whose blood is very much heated, or who are in a violent perspiration. In all which cases an application may be employed, composed of

alum, soot of the chimney, and the white of eggs, beat together. This may be made more efficacious by adding a considerable quantity of opium; its sedative qualities render it well calculated to prevent a flow of the humours towards the joint affected.

On withdrawing the part from the water it should be enveloped by cloths wet with the before named liquid, and frequently renewed.

If, notwithstanding these means, or from neglect of them, swelling and tension have taken place, we should endeavour to fulfil the second indication, that is to say, to dissipate the inflammatory symptoms by bleeding the patient according to his strength, age, natural habit, and the violence of the accident. We should also enjoin low diet, perfect rest, and apply to the affected part emollients, topical anodynes: such as poultices of flax-seed, boiled in a strong decoction of the root of marsh-mallow, the heads of poppies, and the leaves of night-shade; or a poultice made of the soft parts of white bread, milk, and the yolk of an egg, with a little powder of saffron. When the pain is excessive, the poultice may be wet with Sydenham's liquid laudanum, or with a solution of opium.

These applications are to be continued as long as the swelling and inflammation exist; but as soon as they disappear it is proper to have recourse to discutients; such as aromatic wine, spirits of camphor, or of ammonia, poultices composed of the powder of aromatic plants boiled in strong wine, shower baths of soap-suds, or of lie; but, above all, the sulphurous mineral waters, such as those of Barège, Bourbonne, Aix-la-Chapelle, &c.

In serious and dangerous cases, during the treatment, and even a long time after it has ceased, it is necessary for the patient to keep the part affected at perfect rest; because, in one case, movement would keep up the irritation and inflammation; in the other, when the sprain has been considerable, and the ligaments broken, it is impossible to obtain a re-union of them, and restore the strength necessary for the exercise of the functions of the affected parts, without long protracted rest.

When a sprain takes place in the foot, the patient ought not to be permitted to walk until the tumefaction is entirely removed; and as there almost always remains a weakness in the joint, that exposes it to the same accident, particularly in walking quick and without precaution, it is prudent, in order to obviate this inconvenience, to pass around the weak part a very tight bandage; or, what is better, to cause the

patient to wear a stocking made of deer-skin, and laced on
the side, or tight laced boots, so that the joint may be con-
fined in its natural position.

It frequently happens, after the sprain has been perfectly
cured, that the cellular tissue around the joint becomes ana-
sarcous, particularly in the evening, after having been a
long time standing. For this weakness, which may continue
a long time, the proper treatment is to apply a roller, or a
dog-skin, or a linen gayter; taking care to protect the af-
fected parts with lint or cotton.

In other cases the ligaments that have been forcibly dis-
tended and torn become stiff, particularly in joints that are
closely united, their movements are rendered difficult and
painful. In these cases we should have recourse to fomenta-
tions, emollients, steam-baths, liniments, made with vegetable
oil, or the marrow of animals recently killed, or ointment of
marsh-mallow. It is advised by some to plunge the affected
limb in the throat or belly of an ox just killed; but many
persons have an inconceivable aversion to this remedy, and
will not make use of it. When the stiffness of the parts re-
sists all these remedies, recourse must be had to the hydro-
sulphurous mineral waters, of which we have already spo-
ken.

CHAPTER XXIV.

Of Luxations in general.

BY luxation is meant a permanent change, of more or less extent, in the natural relations of the surfaces of the joints, occasioned by external violence or organic tension. We shall consider, in this chapter, luxations in general, and lay down the symptoms peculiar to each, so as to exhibit, at one view, the causes, the signs, the prognosis, and the treatment of these accidents.

The importance of a knowledge of the anatomical structure is evidently necessary in the study of all surgical diseases; but it may be truly said, that the study of luxations is that for which anatomical knowledge is absolutely indispensable. It is impossible to take one step, to conceive one idea as to the manner in which the causes of a dislocation act, of the situation in which a luxation takes place, of the signs that characterize it, or of the curative indications, without knowing, in the most positive manner, the structure of the parts, and particularly the dispositions and relations of the surfaces of the joints; the number, the strength, and the situation of the ligaments; the dispositions and relations of the muscles that surround the dislocated joint, and even of the vessels and nerves that are near it.

ARTICLE I.

Of the Differences of Luxations.

The differences of luxations are very numerous. We shall class them into five kinds—1st. Those which relate to the kind of joint luxated. 2d. The direction in which dislocation has taken place. 3d. The extent of the dislocation. 4th. The space of time that has elapsed since the accident occurred. 5th. The accidental circumstances that accompanied it. We shall now examine these differences successively.

1st. In some joints dislocation is impossible; in others it can only take place in consequence of some enormous force, which would tend rather to fracture the bones than to displace them. Thus, no luxation of the vertebral column ever happens, because the bones are united by means of numer-

ous extensive surfaces, varied in their forms and directions, and retained by means of several powerful and elastic ligaments that permit very limited movements; the greatest violence is hardly capable of displacing the bones of the pelvis, a kind of injury in which, if it be not attended with fracture, the bones may have been disunited, but not luxated, and which is better designated by the word *diduction* than that of luxation. We may confidently assert, from experience, that luxations are impossible in the articulations of continuous surfaces.

The joints of the short bones of the carpus and tarsus, in the carpal or tarsal ends of the metacarpal or metatarsal bones, in all arthrodial joints, and those which permit only obscure movements, luxations can be produced only by great violence. In the ginglymoid joints, where the surfaces are extensive, and the movements confined to two alternate directions, luxation, though very rare, is less difficult than in the preceding case, and the surfaces of the joints are then merely changed from their natural position, but seldom so displaced as to cease to touch each other. But in the round joints, which enjoy the greatest extent and liberty of movement possible, luxations are very frequent. There is, however, in these last mentioned joints, different structures, that vary the frequency of their luxation : thus, it is unusual in the thigh and pelvis, and in the joints where a spherical head is received into a deep cavity of the same form, encompassed by a great number of cartilaginous fibres, and confined, by a short and strong ligament, within the joint, and enveloped by a thick fibrous membrane ;—in the joint of the large bone of the carpus with the scaphoides and semilunare, where a round head is received into an analogous cavity, and firmly fixed by strong ligaments, particularly towards the palm of the hand ;—in the articulation of the astragalus and scaphoides, where, though we find a large head received into a superficial cavity, the parts are secured by extremely strong ligaments and numerous muscles, particularly towards the side of the foot where the greatest solidity is necessary :—in all these parts luxations are extremely rare. But in the joint of the arm and the shoulder, where a portion of a large regular sphere is only resting on a superficial and disproportionate cavity, where the surfaces are enveloped by a thin and soft membrane, enjoying the greatest possible latitude of movement, and only attached to each other by the neighbouring muscles, luxations are very frequent. This joint alone furnishes a greater number of examples than all the others together.

2d. In joints where the movement is inconsiderable, and confined to a little sliding, the displacement can scarcely take place, except in the direction of the lateral movement : thus, in the carpal and tarsal bones luxation rarely takes place in any other way than the direction towards the palm, or from the palm towards the back of the hand or foot ; there are, however, some exceptions, which it is difficult to comprehend : thus, we see the astragalus completely turned over, around its antero-posterior axis.

In the ginglymoid joints, luxation can only take place towards the extremities of two diameters ; one of which is parallel to the natural movement, the other crossing it in a right angle ; thus in the knee joint luxations may happen forwards, backwards, inwards, or outwards.

The different consistencies of the different parts of the articular cavities, some long bony eminences placed in the vicinity of the joint, the distribution of the muscles that surround it, the oblique surface on which the luxated bone rests, the small extent of certain movements, &c. limit the number of directions in which luxations can take place. It is not yet proved by observation that the thigh is subject to more than four kinds of luxation : the humerus is liable only to two ; the body usually opposing so extended movement of the arm forward, as to prevent the head of the humerus from escaping at the outer side of the glenoid cavity, while the acromion and the clavicle prevent a luxation upwards.

A bone luxated from a globular joint, does not always remain in the position it first took when the accident happened, but experiences ulterior displacement. Thus, the humerus, having escaped at the inferior part of the glenoid cavity of the scapula, may be carried inwardly, towards the axilla ; or luxated, in the first instance inwardly, it may afterwards be carried forwards and upwards, and lodge under the pectoral muscle ; a kind of luxation that never takes place in the first instance. To distinguish this kind of displacement from primary luxation, we shall call the former *primitive,* and the latter *consecutive* luxation.

To designate the direction in which a luxation has taken place, the names of the surfaces towards which the luxated bone has been carried, are used : for example, they are called anterior, posterior, &c. according as the bone is carried to the anterior or posterior surfaces : and compound names are given, when the luxated bone after it is removed from its natural seat, takes an oblique direction, as happens to the thigh ; the terms are anterior-superior, anterior-inferior, &c.

are then used. That our language may be well understood we remark, that, in the orbicular joints, the bone with a head is considered as the one luxated, except in the case of the first phalanges of the fingers and toes; in the ginglymoid joints, that which is farthest from the body, and in the arthrodial joints, the bone which produces evident deformity.

3d. Luxations are distinguished into *complete* or *incomplete*. By complete luxation is understood that in which all contact is destroyed between the surfaces of the joints; by incomplete luxation, that in which union still exists, but not in its natural state. In all orbicular joints, it is evident, complete luxation can alone take place. In the ginglymoid joints, on the contrary, the surfaces are so extended, that the violence which causes a dislocation is rarely carried so far as to destroy the natural relations of the surfaces. Thus, the knee and elbow are very seldom so dislocated that the surfaces entirely cease to correspond with each other. These surfaces, being formed of a series of eminences and cavities fitted to each other, a slight displacement may produce unnatural situations and relations of parts, which become permanent: but, if the force be sufficient to push the surfaces of the joints beyond their respective bounds, the displacement becomes considerable, and their contact entirely ceases. In the arthrodial joints, also, the displacement is almost always incomplete. It will be seen that, according to this acceptation, the terms complete or incomplete do not apply to dislocations of the lower jaw, as existing on one side only, or on both.

4th. In recent luxations, although the soft parts have suffered disorder from the displacement of the bone, yet the irritation that results has not existed long enough to produce inflammation of the ligaments and of the cellular tissue, and spasmodic contractions of the muscles. In a few days an inflammatory tension affects the joint, and all efforts to replace the bone are useless, and only aggravate the accident. By degrees the parts become accustomed to the unnatural state in which they have been placed, the inflammation terminates, and the irritation disappears; but, at the same time, other changes take place, which render the reduction more and more difficult. Of these we shall treat particularly hereafter.

5th. Luxations without any disorder in the soft parts about the affected joint, more than inevitably follows such accidents, are termed simple. When the concomitant injury is sufficient to furnish certain indications, it constitutes a complicated luxation.

Luxations may become complicated in consequence of contusion, inflammation, spasmodic contraction of the muscles, the tearing of these organs and the skin, compression or rupture of the vessels or the principal nerves of the member, or of fracture.

In abandoning its natural situation, a bone necessarily tears, distends, and bruises the ligaments and other soft parts around the joint: hence ecchymosis, collections of blood, &c. All these injuries are referable to contusion. When the violence which causes a luxation acts on the joint itself, the contusion is always great.

Inflammation never immediately follows a luxation; it is always a consequence of the contusion, ecchymosis, and effusion of blood, and appears some days after the accident. There is even in the first moments, particularly if the cause of the luxation have been violent, torpor in the joint and the neighbouring parts, that renders it much less sensible than natural: hence, the consequences are less serious than they would otherwise be. But the greater the torpor is the more the inflammation that follows it is to be feared. When it has taken place, and the parts around the joint are swollen, hard, and painful to the touch, any force tending to re-establish the natural relations of the articular surfaces, will be useless, and even dangerous, by adding to the irritation already existing.

In persons whose muscles have acquired a great power, and in those who are timid and fearful of suffering, when the inflammation has taken place, all the muscular system, and particularly those muscles that surround the luxated joint, may be in so violent a state of contraction as to baffle all endeavours to replace the bone. In cases of this nature, the contraction of the muscles would be increased by attempts to lengthen them. When the inflammation is high, such attempts are not only unsuccessful, but very dangerous, as they cause a rupture of the extended muscles, terrible inflammation, mortification, (and particularly if in a great joint of the knee,) convulsions, tetanus, and even death. But the spasmodic contractions of muscles, which originate in fear altogether, are less to be dreaded, and do not oppose any great difficulty to the reduction.

Very frequently the violence that occasions a luxation, ruptures, at the same time, some of the muscles which surround the joint. It is very probable that all the injuries of this nature are not known in certain luxations; there are cases wherein a certain number of these organs must necessarily be broken. This circumstance does not add much to

the severity of these accidents. It is probable, that in these instances, re-union takes place by a mechanism similar to the immediate adhesion of simple wounds; at least we are led to believe this, on considering the rapidity with which accidents of this kind disappear, and the quick return of the freedom of motion to the limb. But the case is very different when the luxated bone has torn, at the same time, the muscles, the cellular tissue, and the skin, and exposed the joint to the contact of air. This case, which is classed among contused wounds of the joint, is one of the most dangerous known; the principal danger depends upon the opening of the joint. Injuries, otherwise equally great, but not accompanied by this circumstance, are seldom attended with serious consequences in the first instance. We have seen a case in which the astragalus was almost completely turned round upon its own axis. It produced only very slight symptoms in the first instance; but afterwards the articular pully of this bone having caused a mortification of the teguments which it distended, amputation of the leg was inevitable.

It seldom happens that the vessels and the principal nerves of the member are pressed, extended, or broken by a luxated bone. These organs enjoy so great an ease of movement from the cellular tissue that surrounds them, that they are pressed to one side, and avoid injury. However, some of them are so disposed as with difficulty to escape injury; the circumflex nerve, for example, that surrounds the neck of the humerus, is sometimes so disorganized by a luxation of the head of that bone, that the deltoid muscle is paralyzed, and the power of raising the arm is for ever lost. A luxation of the lower part of the humerus backwards will sometimes break the brachial artery, and cause a mortification in the arm and hand.

In speaking of fractures, we have already observed, that they may accompany luxations; and we have explained the mechanism of this complication. When this complication takes place in a ginglymoid joint, each of these accidents may be treated at the same time, because the displacement is almost always incomplete; and even in this case, the destruction of the ligaments is so extensive, that moderate efforts are sufficient to reduce the luxation. But, in luxations of a spherical joint, a complication of fracture in the same bone is the more distressing, as to the last of these disorders alone attention can be paid in the first instance, and, by the time this is cured, the other will have become irremediable.

ARTICLE II.

Of the Causes of Luxations.

Among the predisposing causes of luxations may be
classed certain natural dispositions of the joints, morbid af-
fections, and particular attitudes of the limbs. It was thought
that the indentations in the sockets of some of the joints, such,
for instance, as the thigh, facilitated luxations : but these
appearances are only perceptible in skeletons ; in the fresh
state the notches in the sides of the joints are filled up by
substances of a particular nature, designed to augment the
depth of the cavity, and give to it a certain degree of elasti-
city, to allow a greater extent of motion, and render the
union more exact. Thus, the notches on the edges of the
cavities of the spherical joints, so far from favouring luxa-
tions, prevent them, or, at least, render them more difficult.

If the ligaments were the only means by which the bones
were kept together, their strength or weakness would decide
the frequency and direction of luxations ; but the muscles
that surround the joints are the most powerful bonds of
union, although strength or weakness of the ligaments
ought to be considered as influencing, in some degree, the
frequency of luxations : hence, lateral luxations of the gin-
glymoid joints, where the ligaments are the strongest, very
often occur. Luxation of the humerus, downwards, is the
most common ; in the lower part alone the joint is deprived
of supporting muscles. In this joint it is remarkable with
what facility the capsular ligament is distended, when the
muscles are paralyzed ; even when the deltoid alone has lost
its action, the weight of the superior extremity produces a
lengthening of the ligaments and the other muscles, so that
the surfaces of the joints separate, and an interval between
them is plainly observed.

Among the organic alterations, of which the joints are
susceptible, some produce swellings in the cartilaginous
layers that cover their surfaces and synovial glands, and
thus gradually fill up the cavities ; others destroy the liga-
ments ; in which cases trifling causes produce dislocation.
These dislocations are *symptomatic*, but the term consecu-
tive, which has been applied to them, is erroneous ; it more
properly designates the ulterior displacement of bones al-
ready luxated.

In order more readily to conceive how certain attitudes of
the limb facilitate luxations, it is necessary to enter into

some detail relative to the manner in which they are effected, and to give an exact idea of the natural union of the surfaces of the joints.

Whatever be the direction of the surface of a joint in relation to the axis of a bone of which it forms a part, in order to its permanent union with the opposite surface, it is necessary that the imaginary line passing through the centre of the first, which we call its axis, fall perpendicularly on the plane of the second. As long as these dispositions exist a displacement cannot take place; it can only happen when the line in question inclines with respect to the plane on which it falls, and forms an angle with it. In all the varied forms which nature has given to articular surfaces, the application of this general law is observed, and the disposition of the parts is such that this relation remains nearly the same in almost all attitudes. Thus, in a spherical joint, where a head revolves in a round cavity; in the gingly-moid joints, where the surfaces may be geometrically reduced to a cylinder, which revolves, in an analogous cavity, the relations of the surfaces remain nearly as we have described them, while the bones do not execute any extensive movement. But, in articulations by arthrodya, where the surfaces, almost smooth, slide upon one another, the motions, circumscribed by the natural disposition of the parts, always take place in such a way that the axis of one surface of the joint rests absolutely perpendicular to the plane of the other, and the greatest violence is supported in this direction. Now, the distribution of the muscles and ligaments around the joints, and the length of both, tend to oppose all movements that could establish any other relation between the articular surfaces, and consequently produce luxation. It can, then, only be in movements of a certain extent that the axis of one surface can incline on the plane of the opposite surface, and the natural relation is so well maintained by the resistance of the surrounding parts, that the angle of which we are speaking must be very acute to permit luxation easily to take place; the muscles can hardly ever produce a similar movement; but when surfaces of the joints are so placed that the axis of one falls obliquely on the other, they are in the most favourable position for the production of luxation by an external violence. It may then be said, that all extensive movements or attitudes, however incapable in themselves of producing luxation, may efficaciously aid, and become the predisposing causes of it. Thus, an elevated position of the arm is incapably of producing a luxation of the humerus; but if,

when in that position, a fall on the elbow throw upon it the whole weight of the body, luxation takes place, and that attitude of the arm is carried much farther.

The efficient cause of all luxations is violence. In the ginglymoid and arthrodial joints, the effects of a fall, and the violence given to the movements of a limb, may produce partial, and even complete luxations. But, in the sphe-rical joints, surrounded by numerous and strong muscles, those organs constantly unite with external violence in pro-ducing luxations. This co-operation of the muscular ac-tion is particularly remarkable in the joint of the humerus with the scapula. It would seem that the humerus would easily be luxated, because the cavity of the scapula is so su-perficial; but, in fact, this disposition preserves the arm from luxation more than if the glenoid cavity were deeper; its edge does not offer fulcrum to push the humerus from its place, as is the case with the femur, the neck of which leans on the edge of the cotyloid cavity, when the thigh is vio-lently carried upwards. The most extended and rapid move-ments may be given to the arm without exposing it to luxa-tion.

In speaking of particular luxations, we shall carefully explain the mechanism of each, and show the operations both of muscular action and external violence.

ARTICLE III.

Of the Effects of Luxations.

A luxation never takes place without rupture of the liga-ments which confine the bone. In the spherical joints, one of the bones cannot abandon its cavity without tearing the capsular ligament, and the ligaments within the joint, where there are any. It has been thought, that, in these luxations, the opening through the capsule might be so narrow as scarcely to give passage to the extremity of the bone; but it has always been found that this opening has been more than sufficient to re-admit the extremity of the bone; and some-times, instead of a simple opening, the capsular ligament has been seen completely torn the whole length of its con-nexion.

In the ginglymoid and arthrodial joints, the smallest dis-placement cannot take place without rupture of their liga-ments; some joints cannot suffer luxation without a simulta-

neous or previous fracture of a portion. Thus, luxation of
the forearm, forwards, cannot take place without a frac-
ture of the olecranon; a fracture of the fibula or of the mal-
leolus internus singularly favours the occurrence of lateral
luxation of the foot.

A certain portion of the ligaments always remains un-
broken, and its resistance produces a certain attitude of the
limb, which serves as a characteristic sign. Thus, the ro-
tation of the leg outwards always accompanies the luxation
of the thigh inwards, and vice versâ: circumstances which
can only be attributed to that portion of the capsular liga-
ment that has not been broken, and which inclines the great
trochanter forwards or backwards.

The muscles are often lacerated or bruised. In certain lux-
ations of the arm, for instance, the sub-scapularis muscle is
exposed to extreme tension and laceration, &c.

In luxations, great changes must necessarily take place
in the relative positions of the bones and muscles. In those
of the spherical joints nothing hinders an inclination of the
bones; and it is effected by the tightened muscles, which es-
tablish an equilibrium; yet the limb is unnaturally fixed,
voluntary motion is entirely lost, and communicated motion
occasions severe pain. But, in the ginglymoid joints, per-
manent inclination of the limb towards the surface from
which the bone is removed, cannot take place unless the
bone be luxated in the direction of its movements. Thus,
in the luxation of the lower arm backwards, this member is
moderately flexed, and fixed in this position; because the
flexor and extensor muscles are equally tense: but, in la-
teral luxations of the same joint, if the displacement be in-
complete, the contact of the surfaces is still large enough
to keep the limb straight, notwithstanding the extreme ten-
sion of some of the surrounding muscles. Finally, when
lateral luxation of a ginglymoid joint is complete, the bone
tears all the adjacent soft parts, and the ligaments of one
side of the joint, and some of the muscles; here the limb
enjoys a facility of movement proportioned to the extent of
the injury.

In the spherical joints, where the dislocation is always
complete, nothing can limit the extent of the dislocation, ex-
cept an unbroken portion of the capsule, the adjacent mus-
cles, or projecting bones, which always render the limb lon-
ger or shorter than it naturally is; now, these organs, be-
ing more or less extended, bruised, or rubbed, must expe-
rience a considerable change: the soft parts become in-
flamed and thickened, and acquire a sufficient consistency to

resist the greatest efforts. Muscles thus displaced, torn
by a disjointed bone, of which they covered the extremities
like a cap, from the permanent pressure and irritation,
have been known to lose gradually their red colour, and all
other attributes of muscular texture, their fibres become
white and indistinct, so as to make them appear like li-
gaments; the cellular tissue between the muscles thus in-
jured inflames, becomes dense, and contracts firm adhesions
to the adjacent parts.

The articular surface becomes inflamed, and the adhesive
process equally unites the dislocated bone to the adjacent
soft parts. The medium of this union, generally very ex-
tensive, rapidly acquires great consistency, at the same
time preserving its flexibility, and permitting all movements
that are not prevented by adjacent bones, but opposing, with
astonishing force, the return of the luxated bone to its natu-
ral situation.

Some authors have asserted, that the opening of the cap-
sule of a dislocated spherical joint never heals, but that it
suffers the synovia to escape, and lubricate the head of the
displaced bone in its new situation. These circumstances
occur only in the first moments of an unreduced luxation.
When inflammation and its effects take place, the parts are
confounded, and, if an attempt were made to separate them,
they would be found in the state in which we have described
them.

The weight of the body, and the pressure of the luxated
bone on the one that affords it a resting place occasions, af-
ter some time, an excavation, more or less deep, surrounded
by irregular and incomplete borders; the extremity of the
dislocated bone is irregular, rough, and flattened, and pre-
sents hardly any of the characters of an articular sur-
face. We see only the union of two continuous surfaces,
bound together like unconsolidated fragments of fractures,
having made an impression on each other, and being capa-
ble of some extent of motion.

The entire thickness of the bone which serves for a rest-
ing place of the disjointed one, is pushed in and displaced,
as if it had been softened, so as to yield with great facility
to compression. This phenomenon is remarkable in luxa-
tions of the femur downwards and inwards, where the head
of the bone, being lodged in the foramen ovale, presses up
the horizontal branch of the pubis, that forms a part of
the cotyloid cavity, which is considerably diminished, its in-
ferior side being pushed towards the centre.

The impression of the luxated bone upon that which sup-

ports it is remarkable, in whatever direction it rests upon it.
Thus, in luxation of the femur upwards and outwards,
where the head of the bone lies very obliquely on the inferior
and external face of the ilium, and where all the weight of
the body, in standing or walking, tends to slide the head of
the femur upwards, the impression still exists; and though
there is no distinct excavation, like that of the acetabulum,
there is, at least, a series of prominences and irregular ex-
crescences around the part upon which the head of the fe-
mur has pressed; sometimes even this point of the ilium
is depressed, so as to form a projection on the corresponding
internal side of the pelvis. Would the natural consequences
of a luxation produce a softening of bones pressed together?

The cavity of the joint undergoes changes similar to
those of the jaw-bone when the teeth are removed; it
flattens, the edges approximate, the bottom rises, and the
cavity soon becomes incapable of admitting the bone which
it formerly contained. Immediately after a dislocation, the
limb remains fixed in the position in which it is thrown;
by degrees the pain and inflammation cease, the relaxed
or tightened muscles become accustomed to their new state,
and the power of motion is gradually restored. The limb
sometimes recovers the power of making as extensive move-
ments as in its natural state; at other times they are very
limited or lost. This particularly happens in the gingly-
moid joints, luxated in the direction of their movements.
Thus, in luxations of the elbow, the coronoid process of
the ulna lodged in the posterior cavity of the humerus pre-
vents extension; and, on the other hand, the triceps brachi-
alis muscle cannot suffer a sufficient lengthening to permit
the olecranon to revolve, so as to flex the lower arm.

Although, after some unreduced luxations, many, if not
all the movements, may be re-established, the organs of nu-
trition always become less active, as is evinced by the lean-
ness of the muscles and the sensible diminution of the limb.
This alteration is greatest in early youth. This remark did
not escape Hippocrates.

ARTICLE IV.

Of the Signs of Luxations.

Luxations always cause pain and incapability of the limb
for motion of every kind : there are, however, equivocal
signs, which do not distinguish it from fracture, or even
contusion.   The signs of luxation are commemorative and
present.

We have shown that there must be a particular attitude of
the limb to favour the action of external violence in order to
cause a luxation ; in fact, it is almost impossible that luxa-
tion should take place by violence applied directly to the
joint ; the action of the dislocating cause is the more effica-
cious the farther it is exerted from the joint, and upon a
longer arm of a lever.   Luxation is probable when exter-
nal violence acts on or near the extremity of a limb, placed
likewise in a position that will push the extremity of this
bone against the ligaments of its joint : thus, in a fall on
the side, when the arm, far removed from the body, has to
support all the weight on a part of its internal side, it is pro-
bable luxation will take place, and even that the bone of the
arm will escape by the inferior part of the capsular liga-
ment.   These commemorative circumstances may throw
light as well on the nature of violence to which the bones are
exposed as the direction of its action, and lead to presump-
tion of luxation.

1st. Complete luxations cause a change in the length of
the limb.   In the ginglymoid joints this change can only be a
shortening in proportion to the extent of the displacement ;
but, in a spherical joint, the bone may be carried over or
under the articular cavity ; causing, in the first instance,
a shortening ; and, in the second, a lengthening of the
limb ; but, at the same time, as the direction of the limb is
changed, it cannot always be placed parallel to its fellow :
hence, it may be difficult to judge whether it is lengthened
or shortened.   The length of the limb must then be deter-
mined by the eye or measurement.   A disjointed bone can
only be restored to its natural length by replacing it in its
proper cavity, which ordinarily requires considerable exer-
tion ; but it is almost always easy to obtain the same result
in cases where the shortening of a bone depends on a frac-
ture.   When once the natural length is re-established in
luxations, it remains ; but, in fractures, the shortness re-
turns after it has been removed.   Finally, in no case of frac-

ture can there be lengthening of the limb, as is sometimes observed in luxations.

2d. In almost all complete luxations the axis of the limb is changed in its direction. This phenomenon arises from the resistance of a portion of the ligaments of the joint that has not been broken, and a spontaneous equilibrium of the muscles, the contraction of which inclines the limb to one side or the other. The tension of certain muscles, the preservation of a part of the ligaments, particularly in the spherical joints, give a rotary movement to the limb at the time of luxation. Thus, in luxations of the thigh, the point of the foot is turned inward or outward, according as the head of the femur goes to the internal or external side of the joint. These two changes in the direction of the muscles are permanent when they depend on a luxation; whereas, in fractures, the same changes can be immediately removed without effort.

3d. The absolute immobility of a limb, its extraordinary mobility, and the loss of certain movements, are characteristic signs of luxation. In complete luxations of the ginglymoid joints, as of the forearm, for instance, the dislocated limb is absolutely or nearly without motion. In spherical joints, the painful tension of the muscles that surround the luxated bone permit scarcely any spontaneous movement; but generally a motion analagous to that which caused the displacement, can be imparted to it by the surgeon, but it causes pain. In a luxation of the humerus downwards, the elbow is, with difficulty, brought to the trunk, or carried forward or backward, but it is easily raised. Finally, in lateral or complete luxations of the joints having alternate movements, the patient cannot execute any movements of the parts, but the member obeys every foreign impulse.

4th. In luxations with the lengthening of the displaced limb, the general and uniform tension of the muscles that run along it, makes them appear to be more closely applied to the circumference of the bone; but the muscles that answer to the plane from which this disjointed bone is removed are extended and projecting, and either because they support the whole weight of the limb, or because they form, with the displaced bone, the two sides of an angle. This may be easily perceived in the deltoid muscles, in a luxation of the humerus downwards. On the contrary, in luxations where the limb is shortened, the muscles that run along its length are relaxed; but their elasticity, and the contraction produced by irritation, accommodate them to the shortness of the member: hence the extraordinary swelling of their fleshy

parts, and the parts to which they correspond; a striking example of which is seen in a luxation of the thigh upwards and outwards, where the muscles on the inside of the limb form a distinct and oblong tumour.

The parts connected with a luxated bone undergo similar changes. Thus, in a luxation of the thigh, the corresponding buttock is flattened if the bone be carried inwards; but, if it be carried outwards, it is rounder, and the inferior part is either higher or lower than in its natural state, according as the luxation has been above or below.

5th. The circumference of the joint itself presents an alteration in its form worthy of remark. To appreciate this symptom, anatomical knowledge is peculiarly necessary.

When the end of a bone escapes from a cavity, instead of that round edge which before indicated the natural union of the parts, we now distinguish the head of the luxated bone in some part near the joint, and a flatness formed on the joint itself, by one of the neighbouring muscles stretched before the socket; we further perceive the round edge and the depression of the same cavity; the bony eminences situated near the joint, the round edges of which were insensibly lost in the general form of the limb, become more apparent. These remarks are peculiarly applicable to luxations of the humerus, and, in general, are very easily verified in luxations of all the spherical joints, even where swelling has taken place.

The form of our limbs, and the natural relations of the bones, are so evidently destroyed in luxations of the joints, that, when there is not inflammatory swelling, the first glance of the eye discovers the nature of the accident. The natural relations of remarkable processes near the joints being known, the smallest change of situation will immediately strike an attentive observer; but it is not so perceptible when the soft parts are swelled and stretched. In this case, the processes are so deep as to prevent their being distinctly felt.

Nevertheless, a person of some experience may form, at least, a probable conjecture respecting the nature of a luxation, and, when the swelling is abated, a new examination will clear up every doubt. It is of the utmost importance to seize the favourable moment, as soon as it arrives, to know the nature of the accident, as the distorted position in which the soft parts are held occasions the swelling to continue a long time, and, if you wait to be assured of the existence of luxation until this has entirely subsided, it is then too late to attempt to reduce it, and the patient is for ever deprived of the free use of the limb.

ARTICLE V.

Of the Prognosis of Luxations.

In general, every luxation that is not reduced deprives the patient, more or less, of the use of the member. Some useful movements in the limb are indeed restored, but they are always imperfect, and, in the most fortunate cases, the lengthening or shortening of the limb is not removed, nor its unnatural direction corrected. In complete luxation of the ginglymoid articulations the deformity always remains the same; the limb continues often nearly immoveable.

There are, however, some exceptions to this general rule. The arthrodial joints rarely experience extensive luxations; as their movements are naturally very limited, their loss is no great consequence; thus, the scapular end of the clavicle may be dislocated, and not reduced, or but imperfectly, without injuring the motion of the arm. Luxation of the orbicular joints, as they take place more easily, so they are more readily reduced. Complete dislocations of the ginglymoid joints, on the contrary, although less frequent, are more serious, as they are always attended with injury of the ligaments and soft parts: hence, we frequently see examples of luxations in these joints complicated with wounds and projection of one of the articular surfaces. Nevertheless, in complete luxations, particularly where the displacement is trifling, these accidents are very simple, and are cured with great facility. The more recent a luxation, the more easily it is reduced. Simple luxations are much less serious than those accompanied by contusions, spasmodic contractions of the muscles, injury of some nerve or vessel, inflammatory swelling, fracture, or wound, and particularly the projection of one of the surfaces of the joint through the soft parts. This last case is one of the most serious known. Access of air into the joint, and the consequent inflammation of the synovial membrane, rapidly communicates to all the muscular system, and particularly to all the muscles of the limb, an astonishing irritation, which renders extremely dangerous any attempts at reduction.

ARTICLE VI.

Of the Treatment of Luxations.

To reduce a luxation, to keep it reduced, to foresee the consequent symptoms, and to combat them when they take place—such are the general indications which luxations present.

We have before observed, that the more recent a luxation the easier the reduction ; therefore, when a luxation is not accompanied by any accident which absolutely forbids the reduction, it cannot be effected too soon.

Although the limb be not shortened, the irritation of the muscles increases every moment a bone is left unreduced ; and the resistance which the muscles oppose to reduction, is proportioned to the irritation they have suffered.

The extension and counter-extension ought to act on all the contracted muscles, and pull their extremities in opposite directions.

In employing extending and counter-extending forces, no pressure should be made on the muscles that pass over the joint, the lengthening of which is necessary to the reduction of the luxation ; want of attention to this will cause an additional contraction, and consequently oppose the reduction. But some muscles, after having covered a joint, extend the whole length of one of its bones, and are inserted in the following bone. Such a disposition would lead to the inconvenience of which we have been speaking, if the force were applied to the luxated bone itself, or to those which immediately follow it : experience has fully proved, that the farther the force is applied from the luxation, the more certain is its success ; and it never answers better than when made to act at the extremity of the affected member. It is, therefore, of the utmost importance to exercise the extending force as far as possible from the luxation. This principle is the fruit of the experience of several centuries ; for the idea of exercising extension and counter-extension to the bone they were intended to replace, was too natural not to have presented itself in the first instance ; all antiquity recommended the application of the forces to the luxated bone. The veneration inspired by the ancients suffered this opinion to remain in force so long as anatomical knowledge was not permitted, critically and learnedly, to pronounce on a received opinion ; and we can only go back

to the time when the Academy of Surgery shown in its
greatest lustre, to find the origin of the contrary opinion.

The force necessary to be employed in the extension and
counter-extension ought to be proportioned to the number of
muscles to be lengthened, and the degree of their contrac-
tion. Sometimes their resistance is great, and is increased
when the force is applied to the luxated bone. A number of
different means have been devised to augment the force, and
to overcome the resistance; as if the force alone were
necessary, and if its actions were to be invariably in one
direction during the whole time of a reduction. These
means might be useful on account of their convenient ap-
plication only; for otherwise an inevitable objection arises
to their use from the impossibility of calculating the de-
gree of their force: the skin and muscles have been
often lacerated, without the least advantage in relation to
the luxation itself. But these means have another radical
fault, unless very complicated mechanical means be em-
ployed; their action must always be direct and parallel to
the direction in which it commences. Now it will be seen
that the proper mode of reducing a dislocated bone, is to
vary the direction of the force, because the bone was not
thrown from its natural situation by one direct movement.

To the preceding considerations, equally applicable to
extension and counter-extension, let us add the following, re-
lative to each in particular. We have already seen that the
extension ought to be applied as far as possible from the lux-
ated bone; thus, for the arms it ought to act on the wrist,
and for the legs on the foot. The hands of a sufficient num-
ber of assistants applied to the limb itself are certainly pre-
ferable to any other means; although it is incontestable that
in this way the exact force cannot be calculated; and it is
difficult to cause to act together, and in concert, the hands
of persons employed, who frequently pull unsteadily. But
by employing intelligent assistants we may approach to uni-
formity, and the desirable perfection of regularly increased
extension; and, above all, we may vary, at pleasure, the di-
rection of the extension—an incalculable advantage, not to
be obtained by any other means.

The force sometimes necessary requires a number of per-
sons, and the surface of the part may not be sufficiently
large to permit all the power to be applied to the limb; for
this reason bands are used. These ought to be made of
solid materials, not subject to stretch, but so soft as not
to hurt the skin; the simplest and best is linen. We con-
stantly employ sheets or table-cloths folded lengthwise, like

a band, three or four fingers wide, and sufficiently long for the middle to be applied or fastened round the wrist or bottom of the leg. A sufficient number of assistants may be placed at the ends.

The direction of the extension is an essential point of which Hippocrates knew the importance. This astonishing man explicitly recommends the extension to be made in the direction in which the luxation took place; that is to say, by placing, as much as possible, the member in the situation in which it must have been when the accident occurred: and the excellence of this principle was not denied until it was erroneously said, that the extension must be made in the direction in which the limb is thrown. In making extension in the manner pointed out by Hippocrates all the muscles are in an equal degree of tension, and the bone is carried towards the cavity of the joint by the very route it took in leaving it.

The object of counter-extension is to oppose an equal and invariable force to the extension. Like this last, it ought to be applied as far as possible from the injured joint. This precept cannot be conformed to when the luxation is very near the trunk; it must then be so arranged that the bands employed for making counter-extension do not compress the muscles that pass over the joint.

The force of counter-extension ought necessarily to be equal to that of extension; but, as it is not necessary to vary the direction of the former during its action, like that of the second, less intelligent assistants than those destined to make the extension may be employed. Counter-extension ought always to be made in a direction perpendicular to the surface of the joint of the bone on which it acts.

When the extension is carried to a sufficient degree, which will be known by the lengthening of the limb and the flattening of the muscles that surround the joint, we are then to proceed to the coaptation; that is to say, to the conducting of the head of the bone into its cavity; to do which it is necessary to act differently, according to the nature of the joint affected, and the kind of luxation it has suffered. The head of the bone should be always conducted into its cavity by the same course it took in coming out. This is not always the shortest route the bone can take to re-enter. We are, however, obliged to follow this route, even though it is not the shortest, as much because it is the one formed by the disjointed bone, as because it conducts to the opening made in the capsular ligament. Louis has raised doubts as to the importance of this precept, which most authors have

regarded as a fundamental principle in the reduction of lux-
ations. He expresses himself in this manner:—" It is not
clearly proved that this dogma is as important in the prac-
tice as specious in theory. It is said, that if the track al-
ready made is not followed, another must be made, with
difficulty to the operator and pain to the patient; that the
head of the bone, arriving at its cavity, finds no opening in
the capsular ligament, which it pushes before it into the ca-
vity, and which prevents an exact reduction, and causes
pain, inflammation, abscesses, &c. I have seen in practice
all these consequences, but they do not arise from that cause.
I have reduced many luxations, and I have never perceived
that this precise route can be distinguished: the bone is al-
ways reduced, or rather reduces itself by the only course it
can take to re-enter, after the obstacles that opposed its re-
placement are removed, whether by methodical or empirical
movements." The doubts of Louis would be well founded
if he spoke of those luxations only in which the displace-
ment has not been very extensive. It is also just to agree
with this celebrated surgeon, that the ill effects of misma-
nagement are exaggerated, and that they depend more on
the contusion that accompanies the luxation.

But it is also incontestable, that, in luxations where a
consecutive and extensive displacement has taken place, if we
lose sight of this circumstance, great difficulty will be ex-
perienced in the reduction; not from the extension of the
capsular ligament, or from its being pushed before the bone,
but from the irritation of the muscles near which the head
of the bone is directed. Thus, we believe the precept in
question cannot be weakened by the observations of Louis;
and, when the head of a bone, after leaving the cavity,
undergoes ulterior displacement by the contraction of the
muscles, or by any other cause, it ought first to be brought
to the place where it was immediately after the luxation,
and then pushed into its cavity. While the surgeon attends
to the coaptation, the extension ought to be continued, but
less forcibly, and in concert with the operator; the limb
being, at the same time, gradually brought to its natural
direction.

In complete luxations of the ginglymoid joints the process
of coaptation is generally the same as that of which we have
been speaking; but in incomplete luxations of these joints
the coaptation is made by pushing the displaced bone in a
direction contrary to that in which it was luxated, whilst
the bone with which it is articulated is fixed. In this case
the extension ought to be moderate, because its only object

is to diminish the friction of the surfaces of the joints at the moment of reduction.

Considerable difficulties are sometimes encountered in the reduction of luxations; the source from whence they spring ought to be exactly known.

A certain degree of fear augments the susceptibility and energy of the muscular contraction; so that the sight of the necessary preparations, and the apprehension of the pain that will attend it, may add much to the effect of the irritation already caused by the displacement. We have always found it useful, in robust patients, who evinced a good deal of inquietude, to call off their attention by conversing on some other topic while the necessary preparations are making. Certain attitudes, although indifferent as to the luxated joint, favour the contraction of the muscles, and oppose the reduction. We have sometimes reduced with great facility a luxation of the humerus, by making the patient lay on his face, after several ineffectual efforts have been made in a sitting posture. In this case, it is extremely probable that the force with which the patient pressed the ground with his feet, as if to stiffen himself against the pain, produced a powerful contraction in all the muscles, particularly those that surround the luxated joint. This phenomenon a celebrated physiologist* has called *sympathetic energy of action.*

The contraction of the muscles that surround the luxated joint sometimes depends entirely upon the irritation produced by the luxation itself. It is then attended with hardness and prominence of these organs: the contraction which arises from this cause occurs in recent luxations and in young and robust patients. At other times, the contraction of the muscles is connected with inflammation. In these latter cases, when the luxation has happened some time, say two or three days, the joint is stretched, the muscles are not so prominent, and any pressure made near the joint, as well as the least movement of the member, is accompanied by severe pain. It is important to distinguish these cases; in the latter attention is only to be paid to the inflammation; it would be committing a great fault then to attempt a reduction of the luxation; besides, it is more than probable we would not succeed: it would indubitably augment the inflamed state of the parts, and may give rise to serious accidents. In these cases, when a contraction is not joined to an inflammatory state, antispasmodic remedies may be given: opium, given in a full dose, may be very useful, if

*Barthez.

you seize the moment of its effects to try a reduction ; one or
two copious bleedings, warm bathing for a long time, and a
severe regimen, may produce good effects by the sudden de-
bility they occasion. Mild emetics and nauseating medicines
may also be employed with advantage. We once, with great
facility, reduced a luxation of the humerus on a drunken
postillion: there was so little contraction of the muscles, that
we could, without any other aid than our hands, replace the
bone, whilst the students were occupied with the prepara-
tions for the reduction. Facts of the same nature have in-
duced certain practitioners to propose intoxication as a re-
medy to be used in similar cases; but the difficulty is so
easily removed by other means, that it is hardly worth while
to have recourse to this expedient.

Desault, persuaded that the opening of the capsular liga-
ment of the spherical joints was so narrow as to cause dif-
ficulty in the reduction, frequently caused the luxated limb
to be violently moved, with a view of increasing the opening
of the membrane. As soon as he experienced any resist-
ance, in an attempt at reduction, he never failed to exe-
cute this manœuvre; and the reduction was always easily
made afterwards. We cannot adopt the opinion of this
great surgeon; but the facts that have passed under his eyes,
and those of his numerous disciples, are not the less useful :
they prove that extended movements may prevent the spasms
of the muscles, and facilitate reduction.

We have already observed, that in an inflammatory state
of the luxated joint, and the neighbouring parts, instead
of attempting, uselessly and dangerously, a reduction, we
should calm the irritation, and dissipate the inflammatory
swelling. Bleeding, and the application of leeches to the
part may be advantageous. Too much haste cannot be made
to put a stop to this state, which opposes the re-establish-
ment of the natural relations of the bones, as the longer it
remains the more difficult the reduction becomes. As soon
as the pain is calmed, the reduction is to be undertaken,
without waiting for the swelling to be entirely removed :
this phenomenon (occasioned by the difficulty of circulation)
exists a long time from the unnatural position of the parts ;
and, if we wait until it entirely disappears, the reduction
will have become irreducible. But, if not called immedi-
ately after the accident, if the swelling that first takes place
have deceived us as to the nature of the case, or if mista-
ken as to its true character, we did not attempt the reduc-
tion at the proper time, at what epoch will it yet be time to
undertake it ? This is a most difficult question to answer.
Examples are cited of luxations being reduced after several

months, and even at the end of two years. On the other
hand, examples of luxation, much less ancient, merely of
thirty or forty days, where every proper means have been
unsuccessfully tried, are so numerous, that we are led to
believe that the unexpected success obtained in these extra-
ordinary circumstances, has depended on some unknown
causes, which it is not easy to discover.

It is very certain that luxations of the ginglymoid joints
become sooner irreducable than those of the spherical joints.
Ordinarily, when twenty-five or thirty days have passed,
and the bone has not been replaced, the success is very
doubtful, and it is more than probable that the patient re-
mains lame. As to luxations in the spherical joints, although
we have been fortunate enough to reduce some of six weeks,
two months, or even longer standing, we are far from think-
ing that these very rare and fortunate cases ought to serve
as a general rule. Most of the patients who were the sub-
jects of these extraordinary cases were aged and feeble, and,
consequently, the work by which nature attaches a luxated
bone in its new situation, may have experienced some delay
in its progress and developement.* It is very rare that, at
the end of a month, a luxation, even in a sperical joint, is
susceptible of reduction. It is in vain to cause extensive
movements of the limb, with the intention of destroying the
adhesions the bone may have contracted ; for when the parts
on which it is thus fixed are moveable, you draw them with
it : in the contrary case, great disorder is caused without ob-
taining any favourable result with respect to the reduction.
Without having experienced it, one cannot conceive the re-
sistance met with in attempting to remove, from the place it
occupies, a bone that has been some time luxated, and all
the force it is capable of eluding ; the skin, and even the
muscles may be torn and broken without moving the dis-
placed bone. As we cannot know *a priori* of the degree
of force with which a bone is fixed in its new position—
as the time since which it has been in this state is no
measure of it, any attempt at reduction ought to be with
great circumspection, and it must be abandoned as soon as
it is perceived that well combined efforts, carried as far as
prudence permits, are without effect.

A luxation is known to be reduced when, during the ope-
ration, you hear a certain noise, produced by the return of
the head of the bone into the cavity ; the pain is consider-
ably diminished, the member has recovered its length, its
direction, and its natural shape, and can execute move-

* See note F.

ments that the luxation rendered impossible. We ought,
however, to be careful not to make it execute any exten-
sive movements in order to be assured that the reduction
is made particularly in that direction which gave rise to the
luxation; otherwise we shall cause a new displacement, of
which there are many examples.

It is not so difficult to maintain the parts in their natural si-
tuation, after having effected the reduction of a luxation, as to
keep in their natural union the fragments of a fracture. To
guard against luxation, it is sufficient to prevent such move-
ment as the member had previous to the reduction. It is not
important to act on the joint itself, but on the extremity of the
bone, opposite, in its dislocated state, to that which has been
luxated. After a luxation of the humerus, the arm is fixed
against the trunk by means of a bandage that acts on the in-
ferior part of the limb: in luxation of the lower jaw, the
bandage must pass under the chin; in that of the femur, the
patient must remain in bed with the thighs kept together by
a bandage round the knees, &c.

The applications necessary to the affected part differ
according to its situation. It must always be observed
that a luxation, and the manœuvres necessary to reduce it,
are the great causes of the irritation of the joint, and that
the pain and swelling it manifests indicate the use of ano-
dyne and emollient applications. Poultices, fomentations, and
liniments of this nature should be applied whilst the pain
and swelling exist; and, if it be judged necessary, bleeding,
and the application of leeches around the joint; afterwards
disentient applications ought to be employed, with the view of
dissipating the swelling, &c.

We shall not here treat of the complication of luxations
with fracture, wound penetrating into the joint, nor with
the projection of the luxated bone through the torn liga-
ments. The first has been sufficiently dwelt on in treating
of *Complication of Fractures,* and the two others shall be ex-
amined when we come to *Wounds of the Joints.* We shall
content ourselves at present by succinctly calling to mind,
that, in luxations of the spherical joints, complicated with
fracture, this last only is susceptible of reduction; and that,
when the callus has acquired sufficient solidity to sustain
the necessary extensions, the luxation will generally have
become too ancient to be reduced; that, in similar complica-
tions in the ginglymoid joints, both accidents may be treated
at the same time; because most frequently the luxation may
be reduced without the aid of extension, by acting immedi-
ately on the extremity of the luxated bone.

CHAPTER XXV.

Of Luxation of the Lower Jaw.

AMONG the joints formed exclusively by the bones of the head, that of the lower jaw alone is susceptible of luxation properly so called. The displacement of the other bones of the same part is more exactly expressed by the words separation or *diduction*.

All persons are not exposed to luxations of the lower jaw. For this luxation to take place it is necessary that the line of direction of the neck of the condyles, as it passes backwards, form, with the base of the cranium, an acute angle: whereas, in the natural state of the parts these lines form an obtuse angle ; of course a dislocation can only happen when the separation of the jaws is carried to an extreme point. Now, we know that in infants, the branches of the inferior jaw form with its body, or rather with the plane of its base, a very obtuse angle, and that its parts are almost on the same line. By this disposition the condyles of the inferior jaw is articulated with the base of the cranium in an acute angle, the sinus of which is turned forward ; so that to form an obtuse angle forward with this same base, the inferior jaw would be depressed to a degree it could never reach, and which neither the length of the elevator muscles, the natural opening of the mouth, or even the situation of the vertebral column would permit. Hence luxations of the inferior jaw never take place in very young persons, notwithstanding the frequent occasions they have to open their mouths as wide as possible. They are most frequently seen at that epoch of life when the teeth are complete, and when the form of the inferior jaw is definitively fixed.

This bone can only be luxated by being carried before the transverse process of the temporal bone. If we consider the nature of the relations of the articular surfaces, it will be seen, that for the condyles to be luxated backward, and pass under the projection formed by the auditory and the vaginal processes of the temporal bone, the lower jaw must be greatly depressed. It will also be seen, that one of the condyles can be carried outwards only as much as the opposite condyle is carried inwards ; and for this last to make this lateral movement, it must pass under the spinous process of the sphenoid bone ; an effect that cannot be produced without fracture of this process, which can never take

place but by a blow directly on one of the branches, or in the body of it.

Most commonly the two condyles are luxated at the same time; it may, however, occur, that only one of them is luxated. These two sorts ought to be distinguished by giving to the last the name of luxation of the right or left condyle, and reserving to the first that of luxation of the inferior jaw—denominations much more exact than complete or incomplete luxations, which give a false idea of the state of things.

All causes capable of separating the jaws beyond their natural limits, are also capable of producing luxation of the inferior jaw. Of this number are gaping, efforts in vomiting, violent blows or falls on the chin, &c. To conceive the mechanism of this displacement it is necessary to make a few remarks on the disposition of the articular surfaces, and the mechanism of the movements of the jaw. 1st. The greatest diameters of the condyles of the inferior jaw have an oblique direction, nearly transverse; their surfaces extend much farther backward than forward, and the neck which supports their eminences is sensibly bent forward. 2d. The surface of the joint is composed of two parts; one concave and posterior, bounded behind by a fissure and the auditory tube; the other anterior, convex from behind forward, and near the zygoma. 3d. A cartilaginous substance in the joint follows the movements of the condyle, and carries with it the cavity with which it is, in fact, articulated; the lateral external ligament (which alone unites the bones), inserted into the exterior end of the condyle, and into the tuberosity, at the end of the zygoma, is directed obliquely upward and forward when the jaws are brought together, and in an opposite direction when the mouth is open. 4th. The masseter muscle takes nearly a middle course between the body and the branches of the jaw, and carries this bone upward and slightly forward; the pterygoid and crotaphite muscles produce exactly the same effect in that direction; the external pterygoid is designed to carry the neck of the condyle and the articular cartilage forward. The separation of the jaws, which results from depressing the inferior jaw, is not the effect of a simple movement of its own, but is a compound motion, the centre of which is a little below the middle branches of this bone, and as the chin goes downward and backwards, the condyles go forward, each respectively describing two opposite arcs of a circle of unequal sizes; so that the condyles are placed under the transverse processes of the temporal bones, and they re-enter the glenoid cavi-

ties of these bones when the chin is carried upward and for-
ward.

This being premised, it is necessary to distinguish the
cases where the lowering the jaw, considered as a cause of
luxation, is produced by the action of the muscles, from those
where the same movement is occasioned by external violence,
such as a blow, a fall on the chin. &c.

In the first case, which takes place in gaping, in vomiting,
&c. the contraction of the muscles inserted into the os hy-
oides depresses the inferior jaw. As this movement increases,
the external pterygoid and crotaphite muscles carry the con-
dyles forward under the transverse processes of the temporal
bones, and produce a double circular revolution in opposite
directions, by the chin on one part, and the condyles on the
other: at the same time, the condyles advancing under the
transverse processes, and the chin being carried backward,
the posterior surfaces of the condyles are carried below the
convexity of the transverse processes, and the former lux-
ated anteriorly by the external pterygoid muscle, which acts
with increased energy, and with spasmodic contractions in
the act of gaping.

In the second case, when external violence acts on the
chin, and carries it downward and backward. as may hap-
pen in a fall in descending a stairs, or other similar cir-
cumstance, the lower jaw revolves on the condyles, the gle-
noid cavity being the centre of its movement, as it is not
brought forward by the external pterygoid muscle, which is
inert. In this circumstance, the lowering the jaw becoming
more considerable by the continued action of the violence,
the resistance of the external lateral ligaments, the obliquity
of their direction, and even the involuntary contraction of the
masseter. and of the internal pterygoid muscles, luxation
takes place. This effect the more easily follows in this case
without the action of the external pterygoid muscle, as the
masseter and internal pterygoid contract during the action of
the violence; and as these muscles, by reason of their obli-
quity, tend to carry the jaw forward, in bringing it nearer
the maxilla superior, and as the lower part of this bone is
inclined a little forward, the vertical axis of the condyle, and
the superior part of its neck do not correspond with that of
the branches of the jaw. The first, if prolonged down-
ward, would pass behind the angle of the jaw, and form,
with the posterior branch, an angle of thirty-five degrees.
On the other hand, the capsule of the joint cannot fail to be
stretched by the rotation of the condyles, and of the arti-
cular cartilages, the slight displacement of which facilitates

the passage of the condyle under the transverse process of the temporal bone. Under these circumstances, if during the application of violence to the chin which carries it downward and backward, the elevator muscles of the jaw act, as will most frequently be the case from the effect of fear, &c. the condyles become the moveable point of the bone, and are pushed forward.

The mechanism we have just explained differs from that by which most modern physiologists and pathologists have thought that this luxation took place. We shall not speak of the opinion, that, in a forced opening of the mouth, the coronoid processes being carried below the malar eminences, they become the centre of that movement by which the internal pterygoid and masseter muscles thrust the condyles in the zygomatic fossa. This opinion applies only to cases of luxation by the action of the muscles, and it, moreover, takes for granted a displacement of the jaw, which of itself constitutes luxation.

It is generally imagined, that, in depressing the inferior jaw, the condyles advancing under the temporal processes, the obliquity of the branches becomes such that they cross the middle line of direction of the internal pterygoid and masseter muscles, so that the inferior insertion of these muscles being then placed behind the condyles, they act on the angles of the jaw, and carry them upward and backward, by bringing the condyles further forward.

This opinion, which strikes at first sight with such an appearance of truth, has been generally adopted, and we ourselves a long time professed it. On attentive examination, however, it will be found incorrect. In fact, if the inferior zygomatic arch be divided into five equal parts from the tubercle, where the external lateral ligament of the maxillary joint is inserted, to the bottom of the malar suture; the anterior four-fifths of that division marks the extent of the superior insertion of the masseter; if, then, we mark the central point of that space, and from this point draw a horizontal line, passing by the guttural region, it will be seen that this line falls exactly on the bottom of the pterygoid fossa; that is to say, on the point of the superior insertion of the internal pterygoid muscle. Now, in order that, in a forcible depression of the jaw, the branches of this bone cross the middle line of direction of the internal pterygoid and masseter muscles, the condyles must be carried so far forward as to reach, and even to pass the line in question. But so extensive a displacement never took place; it supposes a degree of separation of the jaws that is never met with in

similar cases: a displacement half so extensive cannot exist without a luxation. It then appears to us demonstrable, that, unless we suppose the condyles of the jaw to be displaced forwards, so as to be carried to the anterior part of the zygomatic fossa, and almost behind the spheno-maxillary furrows, which has not been proved, and which appears improbable—it seems, I say, demonstrable, that, in a luxation of the jaw, the internal pterygoid and masseter muscles constantly remain before the condyles, and their agency in the production of this luxation does not materially differ from their natural action; neither has the crotaphite any effect in relation to this luxation, and, if it could possibly have any, it would be that of preventing it.

However, for a luxation of the inferior jaw to take place, the depressing of that bone must be carried so far that the most elevated and convex part of the articular surface of its condyles form a very acute angle with the plane of the transverse process of the temporal bone, and that the sinus be turned backward, and that, in this situation, the condyles receive an impulse forward capable of surmounting the resistance of the anterior part of the membrane of the joints.

With the predisposition of which we have been speaking, an impulsion of the condyles forward, although moderate, may be sufficient to cause a luxation of the lower jaw. Gaping often occasions it. It has occurred several times successively during the effort of vomiting, and in persons whose age and good constitutions appeared to exclude the idea of any morbid predisposition. In this case it appears that the action of the external pterygoid muscle was sufficient to produce the luxation, unless we admit a combined effort of the elevator and depressor muscles; which, indeed, is not without some appearance of probability.

It is not known, by any authentic anatomical researches, how far the condyles of the jaw, after leaving the glenoid cavities of the temporal bones are carried forward. Judging from appearances in living subjects during the existence of luxation, it appears that the condyles do not go far from the transverse process of the temporal bone, and that they stop immediately before it. This is the case in luxations produced intentionally on a dead subject. The capsular membrane of the joint is so pliable as to admit of this slight displacement without being torn, at least in most cases. It appears equally certain, that the external lateral ligament is not broken: its superior insertion being situated in front of the inferior, the condyle is allowed to pass under the trans-

verse process of the temporal bone; and when the first of these two parts has passed before the second, the length of the ligaments is still sufficient, because the condyle is a little raised.

One condyle only is very seldom luxated.

In this case, which equally requires a great depression of the jaw, one of the condyles executes, in the glenoid cavity, or under the transverse process, a kind of rotation, or change, by virtue of which its external extremity is carried forward, whilst the opposite condyle is carried before the transverse process on its side, in a direction a little inward. In this movement the luxated condyle is further removed from the tubercle where the external lateral ligament is inserted, and which must be forcibly extended, or even broken. If, at the moment when a luxation of the inferior jaw takes place, the opening of the mouth be very great, and the distance diminish, in a short time the two jaws re-approach, and the incisor teeth of each jaw are fixed at a distance of about an inch and an half. This phenomenon, which sometimes takes place immediately after a luxation, can be attributed only to the action of the crotaphite muscle, the effect of which is the greater, as its insertion into the coronoid process is then made at almost a right angle, and as there is no obstacle to the movement in question. This movement, however, cannot go so far as to place the teeth in contact; and, on examination, it will be found that the jaws are arrested at the distance which ordinarily separates them. In this case, the immobility of the lower jaw is occasioned by the summit of the coronoid process resting on the inferior border of the maxilla superior. This remark has not escaped the celebrated Monro. When the luxation takes place only on one side, the immediate re-approximation of the jaws conducts the summit of the coronoid process toward the base of the malar eminence of the superior maxillary bone, so that they generally touch; at the same time the last superior malar tooth, on the side of the luxation, rests on the most inclined part of the internal side of the anterior border of the coronoid process. Sometimes the contact that restricts the meeting of the jaws takes place only in this last point; the coronoid process being too short for its summit at the same time to reach the malar eminence.

In luxations of the inferior jaw, this bone is lowered and fixed in this position, and the rows of teeth are separated by a space more or less considerable; seldom less than an inch and a half, and hardly ever exceeding that extent. The teeth of the two jaws do not then correspond: the inci-

sors of the inferior are situated more forward, and if the
approximation of the jaws could be made, these teeth would
be more in front than the incisors of the superior jaw. The
molar teeth present the same want of correspondence, and
each of the inferior meets half the posterior part of the
preceding tooth of the superior jaw. The distance that se-
parates the molar teeth in each jaw is so very small that it is
with difficulty the finger can be inserted between them.
The flow of saliva is augmented by the irritation and com-
pression of the parotid glands, and the lips not being
able to close, it cannot be retained, but involuntarily runs
from the mouth. The articulation of sounds is difficult,
and the consonant syllables cannot be pronounced. In at-
tentively examining the formation of the parts immedi-
ately before the auditory canal, and under the posterior
origin of the zygoma we feel a depression, formed by the
external side of the glenoid cavity of the temporal bone, in-
stead of a projection, which, in its natural state is formed
by the external side of the condyle. The cheeks and temples
are flattened by the lengthening of the muscles that form
them, and we may feel through the cheek, and particularly
in the interior of the mouth, a projection formed by the co-
ronoid process. Such are the signs that characterize a luxa-
tion of the two condyles of the inferior jaw ; but when one
only is displaced, in addition to all these circumstances,
the chin is considerably carried to the side opposite to
that of the luxation ; the depression produced by the dis-
placement of the condyle is distinguishable before the au-
ditory canal of the luxated side only, and the articulation
of sounds is still possible, though very defective, the pa-
tient stuttering when speaking. A combination of symptoms
so evident, it would seem, could not admit of any mis-
apprehension ; yet there are practitioners so little experi-
enced as to mistake a luxation in the inferior jaw for apo-
plexy, and sometimes for a spasmodic contraction of the
muscles that are attached to the os hyoides.

When a luxation of the inferior jaw is not reduced, this
is what happens : in the first instance, the jaw remains
immoveably fixed in the situation it was carried by the lux-
ation ; the saliva at first flows in great abundance, after-
wards in small quantities ; mastication is impossible, but the
diglutition of liquid aliments or drinks is effected by leaning
the head backwards. Examples even have been seen of such
an immobility of the jaw in the situation where it has been
thrown by the luxation, that an anchylosis has been the con-
sequence. This, however, is not always the case. Munro

saw a case where a luxation being unknown. and not reduced, after a certain period, the person recovered the faculty of elevating and lowering the jaw, without, however, being able to bring the teeth of the two jaws into contact. Other examples have been seen where the inferior jaw has gradually raised, so that the lips could be easily brought together and the person could retain the saliva, and swallow without difficulty. It is probable, that but for the obstacle which the os maxillare offers to the entrance of the coronoid process into the zygomatic fossa, the complete elevation of the inferior jaw would gradually take place, and that, by favour of a new joint, formed between the condyles and the anterior part of the transverse apophysis of the temporal bone, the faculty of chewing would be re-established and exercised with facility. Ravaton saw a young recruit who could chew and speak two years after a luxation of one of the condyles of the jaw, though with difficulty; which is more astonishing in this case than after a luxation of the two condyles. The inconveniences of an unknown luxation of the inferior jaw are the loss of the power of pronouncing certain sounds, and the necessity of living some time on liquid aliments or soups, after which the faculty of chewing is re-established. We cannot conceive from whence originated the assertion attributed to the Prince of Medicine, that, if this luxation is not promptly reduced, the most fatal symptoms, lock-jaw and death, may be expected. It is uselessly that some authors have taken great pains to explain this passage. The crotaphite muscle is not more subject to inflammation than all the other organs of the same nature that surround a luxated bone ; and observation has not demonstrated that the inflammation of this muscle is more serious than that of any other. It is impossible that this assertion can be the result of positive observation ; the passage that contains it ought to be considered apocryphal ; it bears none of the characters that distinguish the writings of Hippocrates.

Generally the reduction of a luxation of the inferior jaw is easy, but the repetition is frequent. If, however, we are to believe certain authors, and even to judge from facts, this reduction is sometimes accompanied with great difficulty. We shall presently see on what that opinion is founded. There are only two indications to fulfil in the treatment of this luxation. Serious symptoms seldom occur, at least if the luxation have not been occasioned by some external injury, and there be not, at the same time, contusion, which, however, can never be very dangerous. The only objects are to reduce the luxation, and keep it reduced,

To reduce a luxation of the lower jaw, the patient must be placed on a low seat, his head resting against the breast of an assistant, whose hands must be forcibly applied to his forehead: the surgeon, placed in front of the patient, carries his thumbs (bound round with linen) as far as possible between the two last molar teeth of each jaw, and applies them on the two last inferior molares; the body of the bone being embraced by the three fingers placed obliquely under the base of the jaw; the surgeon presses directly down with his thumbs, so as to carry the whole jaw, downward while the condyles are a little separated from the anterior part of the transverse processes of the temporal bone, the head being firmly held and fixed. This movement is to be executed in a uniform manner, without either raising or depressing the chin; the condyles are then carried a little backward and downward, by pressing the thumbs on the inferior molar teeth, and on the base of the coronoid processes, whilst with the three following fingers the chin is raised and brought forward. A slight shock is then felt, the chin is brought up by the action of the elevator muscles, which announces that the luxation is reduced, and that the condyles have entered into their cavities. At this instant the teeth touch, and with such force and promptitude that the thumbs of the surgeon may be caught; from which cause all authors have recommended promptly turning the thumbs on the exterior side of the molar teeth, between them and the cheeks. It must, however, be acknowledged that this danger is exaggerated, and that you ought to be more fearful of withdrawing the fingers before the proper manœuvres for reducing the luxation are terminated, than of being bitten. It is true, the jaws are brought together immediately after the reduction is accomplished; but this movement is so feeble as to be easily moderated by the thumbs engaged between the two jaws, which more efficaciously act in this case, as their whole length is then placed on the inferior dental arch.

In those cases in which there is luxation on one side only, all the difference in the manœuvres consists in forcibly acting on this side of the jaw alone. It appears, however, that this is the case where the greatest difficulty has been experienced. It is very probable that surgeons have often mistaken the sort of luxation in question, and have acted equally on both sides, and, consequently, in pure loss on that side which was not luxated; or, perhaps, the luxated condyle being carried further forward, the displacement was rendered more considerable, so that the exterior lateral ligament being tightened, forcibly fixed the two bony pieces, and required a

greater force, and a more extensive movement to separate them, and to bring the condyle under the transverse process quite to the glenoid cavity of the temporal bone. This last opinion appears to us very probable.

The ancients have described a process for reducing the jaw, in favour of which Jean de Vigo cites his experience. Instead of the thumbs, two small wooden wedges are placed between the molar teeth; the surgeon forcibly holds these wedges; a band is then placed under the chin; the flat parts pass on the sides of the head; an assistant draws the two ends of the band upward, whilst the surgeon acts with the wedges on the posterior part of the jaw. This process, as may be seen, is founded on an exact knowledge of the proper indications; but it has one real inconvenience, that of elevating the chin before the condyles are disengaged from the unnatural position they occupy. It is preferable, however, to the one Ravaton saw employed with success by an empiric, and with which he appears so highly delighted: It consisted in applying, under the chin, a band of leather, the ends of which were fastened with twine to be twisted by a stick, at the top of the head, on a cap or flat piece of wood, whilst an assistant acted in the same manner slowly under the chin. Ravaton says the operator directed the condyles; but it is evident that his fingers could not employ a force proportioned to that of the leather fastenings, and, consequently, that the greatest force was not applied where it was most necessary. The empiric succeeded, after Ravaton and several others had in vain attempted a reduction by the ordinary means; but, it must be remarked, that one condyle only was luxated, of which they were assured at the moment of reduction. By adding to these means a kind of wedge placed between the molar teeth, or, what is still better, a lever of the same materials, this process might be useful in some ancient luxations, provided the bandage was gradually relaxed in proportion as the lever acted; and the first was only used to sustain the chin at the same height with the angles of the jaw, and not employed to raise the chin until after the condyles were disengaged.

A process, formerly recommended, and which, it is said, was successfully employed, consists in violently approximating the jaws by severe blows of the fist on the chin from below upwards. This is a barbarous operation, and cannot, in any manner, fulfil the proposed end; and, if it could have any result whatever, it would be an increase of the evil, or even of a fracture of the neck of the condyles of the jaw.

It has been said, that the spasmodic contractions of the muscles of the jaw may oppose considerable obstacles to the reduction of a luxation of that bone, and that it is necessary to fatigue the muscles by long continued extension. An observation of Lecat is cited, and another of Dupouy, as proofs of this proposition. But Lecat acknowledges that his was a case of luxation of only one condyle, which had existed fifteen days ; and, it will be found, that, in his embarrassment, he employed a number of manœuvres, which destroyed the effect of each other, and were incapable of extending the elevator muscles ; finally, he took it in his head to seat the patient on the ground, while he stood and practised anew the ordinary method. In this manner he succeeded. " The pressure I exercised with my thumbs," says he, " would, in any other circumstance, have caused me violent pain." It is easy to conceive that only one condyle was displaced. This circumstance, and the time since the luxation had occurred, caused all the difficulty. As to the case of Dupouy, his success is attributed to his pressing with his thumbs on the inner side of the masseter muscles, from within outwards, for several minutes. Will any person believe that the least advantage was derived from that manœuvre?

When the swelling of the parts, or the violent contraction of the muscles, has rendered all attempts at reduction fruitless, before re-commencing them, it will be proper to bleed the patient, steam the affected part, and apply emollient poultices.

To maintain the inferior jaw in its position, it is sufficient to support the chin by a bandage passing under it, the ends of which are fastened on the top of the head ; to prevent the patient from speaking and chewing for some time, and to nourish him at first with liquid aliments ; to recommend him to apply his hand under his chin when gaping, and to make but small movements with the jaw when it is judged proper to permit any : it is essential not to neglect these precautions. Nothing is more common than to see a luxation re-produced by gaping: it is frequently repeated several times in a few minutes, when the surgeon has neglected to fix the inferior jaw, and to render it immoveable for some time. Compresses, wet with resolvent liquids, should be applied before the ears to remove the swelling and to strengthen the parts.

CHAPTER XXVI.

Of Luxations of the Vertebræ.

NOTWITHSTANDING the solid reasons which Hippo-
crates has given, in his book *De Articulis*, to prove that
the vertebræ are not capable of being luxated like other
bones, the contrary opinion was long maintained by respec-
table authors, who cited facts to confirm it.   But, if we ex-
amine with attention the cases in question, we shall find
them possessing the characters of fractures of the posterior
lamina of the vertebræ.   In several instances of this kind
the fragments have been replaced in their natural situation ;
the compression of the spinal marrow has thus been removed,
and the symptoms have consequently disappeared.   Thus we
explain the alleged examples of luxations of the vertebræ,
which, it is pretended, were reduced and cured.   Where
there has been opportunity for examination after death, frac-
ture has almost always been discovered, either of the poste-
rior lamina, or of the bodies of the bones ; and, in the lat-
ter cases, a part of the vertebral column has been found
wrenched, but nothing like luxation has been seen.   If there
be any exceptions to this rule, they are very rare.   We shall
explain them critically.   The structure of the vertebræ, and
the nature of their union with one another is such, that luxa-
tion can hardly take place in the greater number of them.

But, the structure of the two first vertebræ, and then-
ture of their relations with each other, and with the occipi-
tal bone, render them susceptible of luxation.

ARTICLE I.

Of Luxation of the Head upon the first Cervical Vertebra.

The solidity of the joint properly called the occipital,
with the first cervical vertebra, depends less on the ligaments
of that joint than on the disposition of its articular surfaces.
A stratum of soft fibro-cellular substance is placed between
the anterior arch of the atlas and the anterior part of the
great hole of the occiput, another in the back part ; two sy-
novial membranes, covered externally with dense cellular
tissue, envelop the surfaces of the joint ; the surface of
the condyles of the occiput is turned down, and inclined out-

ward ; the lateral parts of the atlas are strongly inclined in-
ward. Thus this joint is like a conical body, the summit
of which is turned down and received into an analogous
cavity, so that the first cervical vertebra must inevitably
follow the occipital bone in all its movements. On the other
hand, the second cervical vertebra, although articulated
with the first, so as to permit a great extent of motion, is
not only very firmly fixed to it, but has an equally intimate
union with the occipital bone : thus this joint derives great
solidity from the proximity of that of the second vertebra
with the third. Moreover, the disposition of the surfaces
of the joint, and its small tendency to movement, adds much
to the efficacy of that kind of supplementary symphysis.

The movements of flexing, extending, and inclining the
head to one side take place almost exclusively between the
several pieces of the cervical part of the spine. As to the
movements of rotation, not only the particular mechanism
of the articulation of the two first vertebræ with each other,
but still more the insertion and the disposition of the mus-
cles specially destined to these movements, evidently prove
they do not take place between the head and the first ver-
tebra. The ligaments, therefore, which confine the os oc-
cipitis and the atlas are not exposed to great violence, since
these bones scarcely move upon each other : hence there is
no example of a displacement of articular surfaces of the
occiput with the vertebral column, in consequence of ex-
ternal violence. Even the large carnivorous animals, who
prey upon the smaller, and who have occasion to make very
violent movements of the head, furnish no example of this
kind. In falls upon the head, in which the vertebral co-
lumn is strongly flexed, though several vertebræ may be
broken, the occipital bone is never luxated upon the atlas.
In the bodies of persons who have died by the cord, the first
vertebra is often found luxated upon the second, but never
the occiput upon the first.

But organic alterations may cause luxations of this kind.
Daubenton has related one case, of which the specimen was
deposited in the King's Cabinet. Sandifort has described
five, which are found in the Museum of Leyden. We have
seen one at the Charité, &c. Sometimes the articular sur-
faces are softened. An exostosis may be formed upon the
transverse process of the atlas, by which this bone may be
pushed forwards or backwards. The anterior arch, the pos-
terior, or one of the sides of the first vertebra has been seen
to intercept a third, a half, or even two-thirds of the diame-
ter of the foramen magnum : yet the patients have lived, at

least until the exostosis which fixed the first vertebra had acquired great size, or until the head and most of the cervical vertebræ had become firmly anchylosed. The first vertebra is always found united to the os occipitis. The articulation of the atlas with the second vertebra, and the symphysis of the occiput with the atlas, are also found to undergo remarkable changes. In one of the cases cited by Sandifort, the lateral displacement of the two first vertebræ, in different directions, was so great that the opposite point of the rings of these two bones intercepted only a space of six lines opposite the foramen magnum. Duverney met with a case in which one of the vertebræ was pushed forwards, the other backwards, and the processus dentatus was approximated to the posterior arch of the atlas by two thirds of the opening of this bone. In these cases the ligaments of the two first vertebræ must have been destroyed, or at least so softened as entirely to have lost their consistence.

Nothing is known of the symptoms which have accompanied these organic changes, nor of the mechanical lesions they have induced. As we are also ignorant of the nature of this disease, we can say nothing as to the treatment which would be proper. Perhaps future observation may discover some analogy between this malady and white swelling, and prove the happy effects of blisters, caustics, &c.

ARTICLE II.

Of Luxation of the first Vertebra upon the second.

Independently of the particular articulation of the processus dentatus of the second cervical vertebra with the anterior arch of the first, these bones enjoy an easy lateral movement, by means of two almost plane surfaces. An extremely strong ligament is stretched transversely behind the processus dentatus, and between the lateral parts of the atlas; two other very firm ligaments pass from the top of the processus dentatus to the internal side of the condyles of the os occipitis: beside these, there are the accessory ligaments, and a ligament which extends from the anterior edge of the foramen magnum to the posterior part of the bodies of the fifth vertebra.

This strong apparatus is intended to permit, and, at the same time, to limit the movements of rotation of the head upon the trunk, which chiefly take place in this triple arti-

culation; and this, although strongly protected, is almost exclusively the seat of sudden luxations of the vertebral column.

The ligaments which surround the articulations of the first vertebra with the second are too weak to oppose any obstacle to luxation. They would yield to the slightest effort which tends to carry the articular surfaces of the atlas, one before and the other behind. In order that this displacement should take place, the rotation of the head and the first cervical vertebra would have to be carried much further than the ligaments which pass from the atlas to the occipital bone would allow; and from this would arise much more serious consequences, which we shall presently explain.

The processus dentatus of the second vertebra may, 1st. Be carried directly backwards, breaking the transverse accessory and lateral ligaments, &c. This displacement is the most rare, because the ligaments must all be broken at the same time, and by direct traction, which requires prodigious force. Hence it happens only in falls from a great height upon the posterior part of the head, by which it is forcibly bent upon the anterior part of the trunk. 2d. In a violent rotation of the head to one side, the lateral ligaments of the processus dentatus and its accessory are put upon the stretch, and twisted around this process; the momentum of the head is opposed by them alone, and not at all by the transverse ligament. If, at the same time, the head is inclined to either side, one of the lateral ligaments, more tense than the other, yields first, and thus renders the rupture of both more easy. When the lateral and accessory ligaments are once boken, if the inclination of the head be carried still further, the processus dentatus may pass under the transverse ligament without breaking it. Louis, in endeavouring to distinguish, among those who died by strangulation, the self-murderer from the victim of assassination, found, that they who were merely suspended by a cord died from strangulation; but those who, after being swung from the gallows, were twisted, had the first vertebra luxated upon the second. The hangman of Lyons, who had reduced his infamous profession to its principles, always produced this effect by sitting on the shoulders of the culprits, and rotating the head, and bending it to one side until he heard the crack, which informed him that he had effected dislocation of the first vertebra upon the second.

In children, the processus dentatus not being completely developed, and the ligaments being longer in proportion,

and less firm, direct traction may stretch and break the lateral ligaments and their accessories, and permit the processus dentatus to pass under the transverse ligament. J. L. Petit saw a child, six or seven years of age, lifted up by a man (in order to see London, according to the vulgar saying) who took hold of the forehead and back of the head. The child struggled, became agitated, and died. It is to be regretted that there was no anatomical examination, though there is little doubt that the first vertebra was luxated upon the second ; and if this were the fact, it must be conceded, that a perpendicular force produced it, and that the processus dentatus passed under the transverse ligament ; for there could have been neither sufficient rotation nor inclination of the head.

Lastly, if the transverse and other lateral ligaments resist the force which tends to rupture them, and to produce a direct luxation backwards, and especially if the processus dentatus has attained its full length, and be somewhat narrower than usual at its neck, it may be fractured at that part, and the lateral articulations of the two first vertebræ are immediately destroyed. In certain provinces of France, in which the executioner applies his feet to the head of men who are hanging, so as forcibly to bend it, this fracture is more frequently met with than direct luxation.

Every luxation of the first cervical vertebra, in which the natural relations of the processus dentatus are destroyed, is immediately fatal. Riolan mentions having seen a soldier who, after being hung, was restored, and whose head was inclined to one side, which he attributed to luxation of the first cervical vertebra, although the man could freely rotate his head. But, we shall presently see that nothing more could have taken place than the luxation of one of the oblique processes of these bones. The moment the processus dentatus is broken, it presses upon the spinal marrow, bruises it, tears it, and produces instant death.

ARTICLE III.

Of Luxation of the five last Cervical Vertebræ.

The convexity of the upper surfaces of these bones in front, and the concavity of the corresponding inferior surfaces, together with the thickness and elasticity of the inter-

vertebral substance, permit pretty extended movements of
flexion and extension. One on each side of the superior
vertebra is received into a cavity in the inferior; thus late-
ral movements take place, and the inter-vertebral substance
admits a slightly rotary motion. In each of these move-
ments the oblique processes, which are almost horizontal,
slide upon one another in opposite directions; in flexion
and extension of the trunk the inferior slide upon the su-
perior of the next vertebra, in a direction upward and
outward; in lateral inclination of the body the inferior
oblique process of the side towards which the trunk is in-
clined, passes upward, and that of the opposite side down-
ward; lastly, in rotation of the trunk, one of these pro-
cesses is carried upward and forward, and its fellow down-
ward and backward. In these different movements the
oblique processes slide upon one another—if they pass
each other, so that all contact of the articular surfaces
ceases, they cannot be returned to their natural situation;
they butt against one another, and the head remains fixed
in the position into which it is thrown. A considerable num-
ber of cases have occurred, in which one of the inferior
oblique cervical processes has been luxated, and in which
the head has been permanently inclined to the opposite side.
Are the two inferior oblique processes of the same vertebra
ever luxated at the same time?

To cause this displacement an extreme degree of rotation
would be necessary; such as could only arise from external
violence. But one of the inferior oblique processes may be
luxated by muscular action. Desault related, in his lec-
tures, the case of a lawyer, who produced one of these luxa-
tions, while sitting in his office with his back to the door, by
turning his head suddenly round to see who was coming in.
Chopart showed us a young man, aged twenty-four, who
met with a similar accident by turning his head too far
round. This person's chin ever after rested upon the left
shoulder, his face being turned to the same side. External
violence may also cause a luxation of this kind, especially
if it causes both a rotation of the head and inclination to one
side. Thus it sometimes occurs in children, in unsuccessful
attempts to make a somerset, or, as it is sometimes expres-
sed, to go heels over head: if they are not strong enough to
straighten the spine, while the head rests upon the ground
it is bent forwards, and generally to one side, and almost
all the weight of the body is thrown upon that side, and
particularly upon the articulation of the oblique process
opposite to the side towards which the head is luxated.

When only one of these processes is luxated, a rotation and permanent lateral inclination of the head and neck follow; the head is carried to the side opposite to the luxation, the face is, also, turned to this side, the patient cannot bring his neck to its natural position, or turn his face to the opposite side. Rotation cannot be effected by taking hold of the head and endeavouring to bring it directly to its proper situation; the patient experiences a vague pain about the seat of the luxation; the spinous processes of the luxated vertebra, and of those which are situated above it, are displaced and carried to the side of the luxation, and incline thence obliquely to the opposite side. This change in the situation and direction of the spinous processes of the vertebræ above the luxation succeeds instantly to the regular arrangement of those of the inferior vertebræ. The sterno-mastoideus muscle, the scalenus, the trapezoides, &c. are in their natural state, and present no sign of spasm, or any other affection capable of producing the remarkable situation of the head and neck. This last characteristic distinguishes the luxation in question from the divers kinds of wry neck, with which it has some resemblance.

It has never been observed, that a luxation of only one of the oblique processes was followed by an inconvenience in the spinal marrow sufficient to produce palsy, or any other alteration in the functions of the nervous system; for whilst the luxated process rises and goes forward, that of the opposite sinks and goes backward; thence results a slight rotation, but too little to give any sensible twisting to the spinal marrow: on the other hand, all the vertebra is not raised; its posterior part only changes its situation, and this is at last reduced to a slight lateral inclination: thus, the distance which naturally separates the posterior lamina is not augmented; there is no stretching, nor compression of the spinal marrow. The only inconvenience which results is deformity, and a sharp pain in the commencement; but which diminishes in the end, and subsequently the anchylosis of the two vertebræ.

It is not known what influence the simultaneous luxation of the two oblique inferior processes of the same vertebra exercises on the spinal marrow and on its functions, as it is probable that the posterior lamina of the luxated vertebra would be removed from that of the following, the vertebral canal would certainly be lengthened, and consequently the spinal marrow would be put upon the stretch. In a case of luxation of one of the oblique processes only, Desault would not undertake the reduction. I have frequently heard him relate,

in his lectures, that a child of eight or nine years of age was brought to him, who, in tumbling heels over head on a bed, luxated the right oblique inferior process of a cervical vertebra; the head was inclined on the left shoulder, the face turned towards the same side: the head was so firmly fixed, that it was impossible to bring it to its natural position, even by considerable efforts. Peyrilhe, who was present, wished the reduction should be attempted, but Desault dared not to undertake it, and, to excuse himself, he told the parents that he could not assure them the child would not die in the attempt. Monsieur Petit Radel relates that he saw brought to the hospital of Charité of Paris, an infant whose neck and head were inclined to one side. The accident happened by a fall several days before. They could not precisely determine the nature of the accident; but suspecting a luxation, they made such manœuvres as the state of the case reasonably required. The child expired under the eyes of those who held it. The body was examined: a luxation of one of the oblique inferior processes of one of the cervical vertebræ forwards was discovered. This will not be wondered at if we consider that to reduce this luxation, we must begin by augmenting the flexion of the spine in the direction of the displacement, in order to disengage the oblique process lodged before that of the following vertebra. Thus we see, that reason and experience alike teach us not to attempt a reduction of a luxation of one of the oblique processes. The accident is exempt from danger; the patient at the end of a little time has only a deformity, with which it is better to persuade him to live, than to attempt a measure, the success of which is not certain, and which may cause his death. Stronger reasons apply to a luxation of the two oblique processes of one vertebra. We have already remarked, that in this case the displaced vertebra must be inclined forward, and the spinal marrow stretched. Now, the tension of that organ cannot be augmented but with the greatest danger, and in the reduction it would be indispensable, in the first instance, to increase the displacement and curvature of the spine at the part affected.

ARTICLE IV.

Of Luxation of the Bodies of the Vertebræ.

Luxation of the oblique processes, such as we have described, and such as has been observed in the cervical region, cannot take place in the dorsal or the lumbar vertebræ, for their processes have much greater elevation, and a vertical direction. But can the bodies of the vertebræ be luxated? It was thought, that, in a violent flexion of the spine, produced by the fall of some heavy bodies on the superior part of the trunk, the spine being already curved; or by a fall from some elevated place on the nape of the neck or the buttocks, or by a violent effort that tended to produce a great extension of the spine, such as tumbling on the ground, &c. —it was thought, I say, that in circumstances of this nature the posterior ligaments of the vertebral column and the cartilages could be broken, and the superior part of the spine, by being carried forward or backward, experience a dislocation. When we reflect on the amazing strength of the intervertebral cartilages, upon the superficial situation of the vertebræ themselves, and their fragility, we shall be inclined to think them more liable to fracture than to luxation; and if we examine the facts upop which a belief of the possibility of their being luxated is founded, we shall find that the posterior lamina of the vertebræ are uniformly broken, often crushed, and reduced to splinters, and that almost always, when the body of a vertebra has been luxated, the separation of its ligaments tears off a piece of the bone itself. Hence we see these accidents have not the proper characteristics of luxation, and belong rather to the class of comminutive fractures, complicated with severe injury of the spinal marrow and surrounding parts.

Before concluding the subject of dislocations of the vertebræ we shall mention that there are facts which prove that in great flexion of the spine, the sub-spinous, the inter-spinous, and the posterior ligaments may be broken. When the injury has not been great, and is confined to the interspinous and sub-spinous ligaments, patients have recovered, after remaining at rest for some time; but the rupture of the posterior ligament is always followed by paraplegia and death, arising, undoubtedly, from sudden distension of the spinal morrow.

CHAPTER XXVII.

Of Luxations of the Ribs.

THE absolute silence of a great number of observing writers, in respect to luxation of the ribs, was not remarked until J. L. Petit and Duverney wrote their treatises on the diseases of the bones. Petit thought it very natural, that the solidity and flexibility of these bones exposed them more to fracture than luxation; and not, probably, knowing any fact in opposition to this conjecture, imitated the example of his predecessors. Some compilers, however, admitted the existence of these displacements, without even citing a single example; and we are astonished to find the name of Pare at the head of those who embraced that opinion.

One of the correspondents of the Academy of Surgery, however, thinking he had observed a case of luxation of the vertebral extremity of one of the true ribs, communicated the fact to the Society in a memoir, in which he established a theory on the subject. The Academy adopted the observations and propositions of the author; and the respect inspired by that association gave credit to a doctrine which appears to us to have been too lightly admitted.

Buttet says, " the last of the true and the first of the false ribs, are alone susceptible of luxation, and the displacement can only take place forward. The luxating cause must always act upon the angle of the rib, or as near as possible to the transverse process with which it is articulated, and in a very small space. The symptoms of this luxation are a sharp pain in the posterior part of the thorax, short and difficult respiration, a mobility of the luxated rib in all its length, *a noise sensible to the hearing and feeling senses,* the necessity of compressing the ribs on the affected side, near the sternum and the corresponding vertebræ, to ease the pain and difficulty of respiration."

In the first place, we observe, that the author founds his theory upon a single fact; and admitting this to have been well observed, we are not authorized to deduce general propositions from it. In the second place, it does not require great attention to discover, from his representation, the symptoms of a fracture of one of the ribs, near its articulation with the transverse process of the corresponding vertebra. There remains not the smallest doubt of this if we put aside certain ambiguous expressions in his narrative. What is a noise that can be only felt and not heard? It is on

this subtile distinction that is founded, according to Buttet, the diagnosis of luxations from fractures of the ribs. According to him, in these last the crepitation is sensible to the organs of feeling only: and in luxations it produces a manifest noise, as if we do not always observe a *sonorous crepitation*, in ascertaining the existence of fractures. Besides, admitting a luxation of the posterior extremity of the ribs, can the extremity of the displaced bone, covered with a cartilaginous substance, in rubbing against the body of the corresponding vertebra, produce a silent crepitation sensible only to the touch? It is true, we may distinguish this sensation, and the noise that accompanies it in luxations of the spherical articulations, although the two surfaces are covered with cartilaginous substances; but in these cases we are obliged to use force, the movements are very extended, and the head of the luxated bone, in entering into the cavity, falls into a deep excavation; but in surfaces almost plane, moving freely and without obstacle upon each other, and in very circumscribed space, nothing but fracture can occasion crepitation, or any thing like it.

Finally, the case cited by Buttet does not demonstrate the existence or possibility of luxation of the ribs, because his patient being cured, he had no opportunity of making an anatomical examination.

Some observers have applied the term luxation to cases of disarticulation of the ribs at either of their extremities, in consequence of the destruction of the vertebræ or sternum, or of the ribs themselves, occasioned by aneurism, or other organic lesion.

There is not a single, a well authenticated example of a luxation of either of the extremities of the ribs; and this will not appear extraordinary when we reflect on the length of these bones, their structure, suppleness, the flexibility of their cartilages, the solidity of their sternal and vertebral articulations, the number and the thickness of the muscles that envelop them, and the facility with which these bones are broken, &c. What shall we think, however, of the precepts given, and propositions advanced by some authors, such as Tucker, Heister, &c. They have distinguished several species of luxations of the posterior extremities of the ribs; and have given several methods for reducing luxations upward and downward. They say, that when the luxated rib is carried inward and forward, the case is most dangerous. That this luxation may be accompanied by a very serious inflammation of the lungs, and if the ordinary methods and different positions of the patient do not succeed in procuring

a reduction, we must not hesitate to make an incision, and seize the rib to bring it to its natural situation, &c. It is evident they wrote on a case they never saw ; or if they have seen the accident they speak of, they have attributed to a pretended displacement effects caused by one or more fractures. We cannot, however, pay too great attention to these last kind of accidents, which arise from violent percussion of the thorax.

The cartilages of some of the ribs are exposed to a particular displacement, which may be classed with luxations, but of which there are few examples. The cartilages of the sixth, seventh, eighth, and ninth are bent upwards, their superior edges are concave, and in the middle they are considerably enlarged, so that they touch, and are articulated together, at one or several points of their respective edges. A synovial membrane is attached to their corresponding plane surfaces, and some fibrous fascia are distributed upon both surfaces of the cartilage. These articulations are seldom exposed to any considerable efforts. However, when the body is thrown backward, or falls backward, the violent contraction of the abdominal muscles, tending to re-establish the equilibrium, may cause a rupture of these ligamentous fibres, and a displacement of the cartilages, the inferior of which passes backwards, and then rises, pushing forward the superior, which appears to be the one which has suffered the displacement. In an observation of this kind,* reported by Martin of Bordeaux, the patient, an old man, in playing with a child, was thrown backward, on the back of a chair ; his body was suspended in this attitude for some seconds, the head hanging on one side, and the inferior extremities on the other. In the reiterated efforts he made to raise himself the displacement occurred. We have seen a similar case, and the accident was occasioned by similar circumstances.† At the instant the displacement took place, the patient experienced a sharp pain in the affected part, and the projection of the superior cartilage was immediately distinguished; a little spasm of the muscles of the breast, and slight difficulty of breathing, have been known to follow directly after the pain ; but it is probable, if the reduction were effected by art, it would spontaneously take place in the movements of respiration ; or, if it did not take place, the cartilage would contract new relations with the adjacent parts, and the movements of the thorax would be quite as free as ever.

* Journal de Medicine, vol. i.
† See note G.

The reduction is extremely easy ; it is sufficient slightly to compress the cartilage that projects externally ; it slides on the superior edge of the following one, and this last is soon brought to its natural situation. If any difficulty is experienced, it may be obviated by gently throwing the body backward, keeping the parts at rest, and applying compresses wet with resolvent liquid, is all that is afterwards necessary.

CHAPTER XXVIII.

Of the Separation of the Bones of the Pelvis.

THE ancients believed that the separation of the bones of the pelvis was necessary to the expulsion of the fœtus. Perhaps they were led to this conclusion by observing that this phenomenon takes place in certain domestic animals. Whatever be the fact in regard to this, the opinion prevailed until the revival of letters. At this period some denied that any separation of the bones of the pelvis took place, and others maintained the contrary opinion. A. Parè gave a noble instance of honourable conduct. He strenuously supported the opinion which is contrary to the separation of the bones of the pelvis ; but he made a public avowal of his error as soon as it was shown him. A woman, aged twenty-four years, being executed for infanticide, twenty days after her delivery, was dissected in the School of Surgery, in the month of February, 1575, in presence of a great number of learned persons. Before the dissection was commenced, the right thigh was raised up, and it was distinctly seen that the os pubis of that side was higher than the other by at least half an inch : there was an interval of a fingers' breadth between the two ossa pubis. The motions communicated to these parts convinced every spectator that the sacro-iliac symphises were much more lax than natural. All were struck with admiration : they saw and felt the truth of the facts.

Various opinions have prevailed on this question. The following is the real state of the case: In the natural state, the articulations of the ossa pubis with each other, and of the sacrum with the ossa innominata do not allow of any motion, although the opposite sides of the two ossa pubis touch each other. In almost all women, in the course of pregnancy, and particularly in its latter stages, the ligaments that unite

the bones of the pelvis are slightly relaxed, as is proved by
anatomical examination; but this relaxation, which does not
always render perceptible a slight mobility of the bones of
the pelvis, and which renders its circumference a little
larger, does not facilitate the expulsion of the fœtus, because
the superior brim of the pelvis does not form a regular cir-
cle, and the slight enlargement which takes place does not
increase its antero-posterior diameter. In some rare cases,
the relaxation of the ligaments is carried much farther, so
as to permit very evident and extensive movements of the
three great bones of the pelvis. They have been known to
admit of a separation of more than an inch in the parts in
which they are mutually articulated with each other. In
some instances the ligaments have been found not only elon-
gated, but so soft as to be easily torn by the fingers, or even
destroyed. The patients, in whom this last circumstance
has been observed, died of puerperal fever. Professor Bau-
delocque and I met with an instance of this kind, and it ap-
pears that the local affection in question may be considered as
a symptom of that disease.

The frequency of the occurrence of this relaxation would
appear to prove that it was intended for some important pur-
pose; but physiology has not yet discovered what this pur-
pose is. Cases of extraordinary mobility cannot be fairly
cited in proof of the uniform course of nature; but this
phenomenon is not most frequently met with in women who
are deformed, and thus deprived of the power of natural
parturition; but even well formed females, who have had an
happy and easy delivery, have been exposed to great danger
from the occurrence of this separation. It seems that re-
laxation to a certain degree is natural;—beyond that degree
it is a serious disease.

Notwithstanding this consideration, it is incontestable, that
a moderate separation of the bones of the pelvis is a favour-
able circumstance for the operation of dividing the symphy-
sis pubis. This operation, which has been the subject of
everlasting discussion, and which has never been considered
cooly and candidly, ought not, in our opinion, to be totally
rejected. Numerous observations prove its utility in cases
of moderate deformity of the pelvis; but it would be much
more useful in cases where the bones are moveable upon each
other, provided the mobility were not very great, and the
moveable articulations were not the seat of acute pain.

The analogy between the cases in question and another
kind of separation of the bones of the pelvis, which comes
on spontaneously, and which has been attributed to scrofula,

leaves us in doubt if pregnancy is the only cause of the relax-
ation of the symphysis of the pelvis which is observed after
delivery ; however, it has not been remarked that those wo-
men who, after delivery, gave evidence of a separation of
the bones of the pelvis, showed any other symptom of scro-
fula. It is a fact, worthy of observation, that this relaxation
has hardly ever been observed in rickety women with de-
formed pelvis. This proves how little effect the pressure of
the fœtus, or any other mechanical cause, has to do with the
production of this disease. They may, indeed, aggravate it
when it exists, but we think they cannot cause it, unaided,
and uninfluenced by pregnancy, or some morbid predispo-
sition.

A woman whose pelvis is relaxed towards the end of preg-
nancy experiences pain in the pubis, or in the groin, and in
the superior and posterior part of the buttock, opposite the
articulations of the sacrum with the bones of the ilium. These
pains are at first very slight, and are only felt during violent
movements, after long continued exercise, or after efforts to
lift heavy burdens: they gradually increase with the pro-
gress of utero-gestation, and are sometimes so violent when
the woman is brought to bed, as to render delivery tedious
and difficult, by preventing the patient from using exertions
to favour the contractions of the uterus. The action of this
organ is sometimes suddenly suspended at each pain, and its
contractions have neither the same energy, duration, or fre-
quency. Sometimes, however, after the accouchment of a
healthy woman, an evident relaxtion, and considerable move-
ments of the bones of the pelvis upon each other, take place,
without having been preceded by pain or difficulty of walk-
ing during pregnancy. Is this state of the articulations, in
such cases, the effect of delivery, or do the relaxation of the
ligaments, and mobility of the bones of the pelvis, exist with-
out any apparent symptom, or is there any concealed disease
which accouchment brings into action ? It does not appear
to us probable, that the mere distension of the ligaments
could break them if they were in their healthy state.

It has been said, that the bones of the pelvis become re-
laxed only in women who had edema of the lower extremities,
and who were weak and sickly. This is not the fact. This
disease often occurs in females of strong constitutions, and
in every respect, except that alone, perfectly healthy.

The mobility of the bones of the pelvis is never very re-
markable before delivery, except in some extraordinary
cases. At this period it is generally very sensible ; it pro-
duces pain when the patient turns in bed, or even bends the

thigh upon the pelvis. In some rare cases the same circum-
stances produce, also, a grating sensation, and even an audible
crepitation. If, then, we place one hand upon the pubes, and
the other upon the upper part of the buttock, and direct an
assistant to push the superior part of the thigh upward and
outward, we shall perceive that the corresponding pubis fol-
lows its motions.

While the pains continue in the degree we have described
them, the patient is unable to go about. If the disease be not
complicated, and no new causes of irritation occur, the pains
spontaneously cease, and the irritation subsides; the mo-
bility, and sometimes even the crepitation continues, but the
patient is enabled to go about. Standing and walking are per-
formed at first with difficulty, and are always executed with
tottering and lameness, which continue during life. In
some instances, exercise occasions a return of the symptoms,
and even death. In other cases, the cure, though imperfect,
is permanent.

In many women no preternatural mobility of the ossa in-
nominata is perceived until they quit their bed, or even un-
til they begin to work after their confinement. Slight pains,
a sense of numbness in the lower extremities, an unsteady
gait, and frequent falls, are the only symptoms that charac-
terize this disease. Some cases seem to prove, that a slight
degree of this affection will get well by the efforts of na-
ture alone.

Pain in the affected part denotes a higher degree of the
complaint. There is then danger of inflammation, suppura-
tion, and the complete destruction of the joints. Fistulous
openings take place, and death always follows. There is no
example of a case of this kind terminating by anchylosis.

We have already remarked, that those women in whom
the ligaments of the pelvis were found, upon dissection, to
have lost their consistence, or their continuity, died of pu-
erperal fever. It is more than probable, that, had they es-
caped this last disease, they would have died of the affection
of the articulations.

While there is pain it is proper to combat the inflammation
of the ligaments (which, from the structure of the parts,
must be chronic) by general bleeding, the application of
leeches over the seat of the pain, emollient fomentations,
and poultices, anodyne liniments, and, above all, by the
most perfect rest and suitable diet. Baths would be useful,
were it not for the necessity of avoiding every kind of motion.

When the pain and irritation are removed, the next object
is to strengthen the relaxed ligaments. Cold baths, topical

astringents, and tonics have been highly recommended for this purpose. But the state of pregnant and puerperal women does not admit of the application of the cold bath; and the local application of tonics appears to be of doubtful efficacy. But the good effects of compressing the pelvis by a bandage passed around it; or, what is still better, a leathern girdle, stuffed on its inner side, and buckled, are abundantly proved by experience. The patients always experience relief from them, and never fail to tighten the straps as soon as they become loose. Rest undoubtedly is beneficial in all cases; but many women get well by wearing a girdle, without ceasing to pursue their usual occupations.

There is another kind of separation of the bones of the pelvis, probably arising from scrofula, that occurs in children and young persons. It affects only the symphysis pubis and one of the sacro-iliac articulations. Sometimes it comes on spontaneously; at other times, after a fall, a blow, or long continued exercise. External causes have, in our opinion, little influence in the production of this disease.

It commences with a pain in the groin, buttock, and part of the affected limb. These are, for a long time, its only symptoms. At length the limb appears longer or shorter than that of the other side. This difference continues the same during a certain period; pain and numbness in the whole limb then follow, and walking is difficult or impossible; the leg and thigh are not completely extended; the point of the foot is turned slightly outward; the respective distances of the malleoli, trochanters and iliac crests of both limbs are the same, but the hip bones are not of the same height.

This disease may continue a very long time. Its duration varies from one month to several years. Sometimes, after an attack of fever, or without any known cause, its course is arrested; but these cases are not generally permanent: the disease commonly returning, after a time, with increased violence.

In a case, published by l'Heritier, in Foucroy's Journal, after the patient had been two hours on horseback, the affected limb was two inches longer than the other; after walking it was nearly as much shorter. When the limb was lengthened, the patient experienced severe pain; in order to relieve which, he walked until it became shortened. These variations in the length of the limb could not be produced by any other means, although crepitation took place in the sacro-iliac articulation when the leg was moved. There was,

at the same time, a disease of the hip joint, and almost com-
plete anchylosis.

When the disease has reached this point, the inferior extre-
mity becomes considerably shrunk and weakened ; the pains
and the swelling of the buttock increase. abscesses form
around the sacro-iliac articulation, fistulæ succeed, hec-
tic fever ensues, and the patient dies, sooner or later, ac-
cording to the facility with which the air enters the cavity of
the joint. On dissection. the bones are found diseased.

The diagnostic symptom of this disease is this ; that in all
the differences in the length of the limb which takes place
the distance from the trochanter major to the crest of the
ilium always remains the same. By attending strictly to this
circumstance we were once enabled to pronounce positively
upon a case which had embarrassed many of the most emi-
nent surgeons of Paris, and which had been mistaken for
consecutive luxation of the hip joint, with which this affec-
tion has some analogy.

When this disease terminates favourably anchylosis pro-
bably takes place in the diseased articulation ; but this is not
yet proved by observation.

It is also very probable that the general treatment of scro-
fulous affections of the joint would suit this case. But we
know nothing from direct experience either of the effects of
bitters, tonics, antiscorbutics, alkalies, &c. or of rubefacients,
issues. moxa. setons. or radiated heat. The patient, whose
case is related by l'Heritier, experienced relief from an ap-
paratus which supported the weight of the affected extre-
mity on the opposite shoulder, at the same time that circular
compression was made around the pelvis. This last effect
was that from which the principal benefit was derived.

Experience has demonstrated. that the articulations of the
bones of the pelvis. notwithstanding their great strength,
may be luxated by external violence. The os sacrum may
be pushed forward ; the ossa ilia may be displaced forward
and upward ; the bones of the pubis may be completely dis-
articulated, and thus enjoy evident mobility.

These luxations are always incomplete, and are necessa-
rily attended with a rupture of all the connecting ligaments.

Enormous force alone can cause such accidents : such as
falls from a great height ; the falling of a heavy body on
the pelvis. Hence the luxation is generally the smallest
part of the injury, which is commonly accompanied with
commotion of the spinal marrow, effusion of blood in the
pelvis or abdomen, &c. Yet instances are related of luxa-

tions of the bones of the pelvis, or rather of rupture of some
of its ligaments, by violent movements ; such as are made in
fencing, &c. But we think there must have been some an-
terior disease.

The first effect of a luxation of the bones of the pelvis
is an incapacity of standing, walking, or even moving the
lower extremities. Acute pain, increased by motion, is felt
in the groin, in the region of the pubis, and opposite the sa-
cro-iliac articulation. One of the bones of the pubis is higher
and more prominent than the other ; the ossa innominata are
susceptible of extensive movements.

Such accidents may terminate fatally, in consequence of
inflammation of the peritonæum or the viscera of the pelvis
and abdomen, or merely in consequence of suppuration be-
tween the articular surfaces, or in the cellular tissue of the
pelvis.

An interesting case of luxation of the bones of the pelvis,
which terminated favourably, is related in the Memoirs of
the Academy of Sciences of Dijon. The left os innomi-
natum was displaced upward. The reduction was delayed
so me days by the presence of inflammation ; when that was
removed, it was attempted, but the pain and inflammation re-
turned. After some days it was tried again, but with the
same result. The patient was confined to bed, but not so
long as the surgeons wished. When he began to walk, the
weight of the limb drew the bone to its place. The cure
was perfect. Ought not this case to teach us not to endea-
vour to reduce a luxation of the bones of the pelvis, but
merely to moderate the inflammation?

We shall conclude this section with a few words in relation
to the os coccygis.

The base of this bone is connected to the sacrum by a sub-
stance like that between the vertebræ ; the periosteum passes
from the coccyx to the sacrum in front; and this connex-
ion is further strengthened by strong ligaments behind ; the
elasticity of these bonds of union permit the coccyx to move
upon the sacrum, and the parts of this bone to move upon
one another, but in a very limited degree, especially in
adults. If the movements are carried beyond a certain point,
the ligaments are broken.

The pressure of the head of the fœtus, in parturition, was
long believed to push back the os coccygis to a degree that
would amount to a sprain, or even to a luxation, if the pel-
vis was narrow. The tediousness of certain labours were
regarded as depending upon anchylosis of the os coccygis,
and it was directed, in such cases, designedly to luxate it

backward, by introducing the finger into the rectum.   But since accoucheurs have employed themselves in observing facts, instead of forming hypotheses, they have discovered that the antero-posterior diameter of the lower brim of the pelvis is large enough to admit the head of a full grown fœtus, and that the retrocession of the coccyx is always very small, and never essential to delivery; and that the anchylosis of this bone, and of the parts of which it is composed, can never oppose any considerable obstacle to delivery. Smellie saw two women who had easy labours although the os coccygis was not capable of the slightest motion.   It can never be proper to luxate this bone to facilitate the expulsion of the fœtus.

It cannot be denied, however, that in some rare cases of great deformity of the pelvis the os coccygis is pushed very far back, and the ligaments strained by the head of the fœtus; but no permanent displacement takes place.   In such cases, the women experience pains in the lower part of the sacrum, increased by motion, coughing, sneezing, &c.   The patients cannot sit, and are obliged to lay upon their backs.   Rest soon dissipates these symptoms.   Topical applications are inconvenient; attempts to reduce this pretended luxation would be highly injurious.

Blows, falls upon the os coccygis, may distend its ligaments, and push it forward; but the natural elasticity of the parts soon brings it back to its place. Yet the consequences of the contusion of the adjacent soft parts, which sometimes accompanies these accidents, are, occasionally, very serious. J. L. Petit relates several cases of this kind, which occurred in women from the want of proper assistance.

In cases of this nature, although there may be no marks of contusion, nor any ecchymosis under the skin, pain is felt opposite the apex of the sacrum, extending over all that bone, sometimes even toward the loins and the thigh, increased by every exertion, and especially by that which occurs in going to stool, together with a sense of weight in the region of the rectum, and, sometimes, even with dysentery.   The pain either diminishes after several days, and gradually goes off, or it becomes pulsating, and an abscess forms in the region of the sacrum.

In the treatment of these accidents the patients must maintain the most perfect rest until the inflammation has entirely subsided, and not the slightest pain remains.   When they first leave their bed, they should sit upon a circular cushion, or a seat with an opening in the centre.

All topical applications of an emollient or anodyne kind

are useful. We have seen excellent effects produced by opiate liniments, fomentations with a decoction of poppy heads, the leaves of night-shade, and hyosciamus, employed soon after the accident.

In diseases which confine patients a long time on their backs, the ligaments of the sacrum are sometimes destroyed. We saw a case of which the coccyx was entirely separated from the sacrum, and carried forwards. As cicatrization took place, it returned to its natural situation.

CHAPTER XXIX.

Of Luxations of the Clavicle.

THE clavicle is exposed to frequent and considerable violence. The smallness of its diameter, and its arched form render fractures a frequent consequence of falls upon the shoulder. This bone would, also, be often luxated if the mode of its articulation with the adjacent bones, and the small movements it executes, did not prevent. Thus luxations of the clavicle are much more common than fractures. We shall treat, separately, of luxations of the sternal and of the humeral extremities.

ARTICLE I.

Of Luxations of the Sternal Extremity.

Directed obliquely forward, outward, and downward, between the scapula and the sternum, the clavicle articulates with this last at an obtuse angle, the sinus of which is turned forward, in consequence of the internal extremity being curved backward: hence, when the shoulder is carried backward, although the natural obliquity of the clavicle is greatly augmented, its axis continues perpendicular to the articular surface of the sternum, and rarely forms an acute angle with it, unless at the moment of a sudden, unexpected external impulse.

Another circumstance in the relation of the clavicle with the sternum merits great attention, and accounts for the small

number of displacements which occur. There is a cavity in
the superior lateral edge of the sternum, the sinus of which
is turned obliquely upward and outward. This cavity is co-
vered with a diarthrodial, cartilaginous substance, and re-
ceives the extremity of the clavicle, which also presents a
deep horizontal sinuosity, embracing a corresponding pro-
jection of the sternum. This structure prevents luxations of
the sternal extremity of the clavicle, or at least renders
them very rare. There are, however, examples of this lux-
ation forward, produced by very slight causes, in young per-
sons and in females.

There is no example of luxation of the clavicle either
downward, upward, or backward. Luxation of this part for-
ward is the only one of which an authentic case can be cited.
The cause of these luxations was sudden external violence,
which tended to carry the shoulder forcibly backward. In
this movement the anterior part of the articulation must be
stretched, and the ligaments, perhaps even a part of the in-
ferior tendon of the sterno-cleido-mastoideus muscle, must
be ruptured; it is probable, also, that the middle of the
clavicle rests upon the first rib, which thus forms the ful-
crum of the lever. We have seen a luxation of this kind,
in a young lady, caused by violent attempts to draw her
shoulders back, in order to make her sit gracefully. This
force would not produce such an effect in persons more ad-
vanced in age. An accident of this kind, however, has oc-
curred in an adult, whose shoulders were drawn back while
the body was pushed forward by a knee placed on the poste-
rior part of the chest.

The muscles take no part in producing this luxation. On
the contrary, if the pectoralis major and the serratus mag-
nus had time to contract before or during the action of the
violence, they would counterbalance it. It is very probable,
for example, the luxation would not have taken place in the
baker, cited by Desault, if he had foreseen, in time, the
fall of his load, from the weight of which he was easing
himself, by resting it on a post behind him.

Some cases are mentioned of luxation of the sternal ex-
tremity of the clavicle forward from falls, but without any
details. If the fall took place directly on the point of the
shoulder, it is probable it would be fractured sooner than lux-
ated. We think the resistance of the ground would act
obliquely on this part so as forcibly to drive it backward.

We believe no cause is capable of luxating the external
extremity of the clavicle backward, except violent contu-
sion directly upon the part; and in this case the luxation,

very probably, would be complicated with comminutive fracture.

Luxation of the clavicle forward is easily discovered. The action of the cause that carried the shoulder, in a sudden manner, backward; a sharp pain in the articulation; a sensible depression of the shoulder, which is resting very near the breast; the change of the direction of the clavicle; a tumour in front of the sternum and under the level of the other sterno-clavicular articulation, formed by the internal displaced extremity of the clavicle; a depression, situated higher, and formed by the cavity the clavicle has left; an inclination of the head and neck towards the side of the luxation; the feebleness of the corresponding arm, and the difficulty of moving it forward, and of elevating it—such are the phenomena that characterize this luxation.

Luxation of the internal extremity of the clavicle forward, is an accident of very little moment, and is never followed by any serious consequences, although the greater part of the ligaments that surround the articulation be torn. But, as it is impossible to keep this luxation exactly reduced, there always remains more or less deformity, which, however, does not injure the functions of the clavicle; and when the pain is entirely dissipated, and the ligaments consolidated, the movements of the superior extremity are executed with the same facility as before the accident.

The following is the manner of reducing a luxation of the internal extremity of the clavicle forward: The patient being seated on a stool or chair, the surgeon standing on the side of the luxation, places one hand on the superior internal part of the arm, and the other hand on the inferior external part of it, above the elbow, and pushes this last part toward the body, while he carries the superior part of the arm outward; he thus converts the humerus into a lever of the first kind, by which he acts directly on the clavicle, as in cases of fracture of this bone. In the combined efforts of the two hands, the shoulder must be brought backward and upward, and the elbow directed forward; so that the direction of the extension is parallel to the axis of the clavicle; that is to say, outward and backward, and a little upward. The wedge-like pad of Desault for fractures of the clavicle, may be placed in the axilla, instead of the hand, which is then to be applied to the internal superior part of the arm, and serve as a fulcrum to the humerus. If the extension is not sufficient to bring the extremity of the clavicle into its cavity, it should be pushed backward.

As soon as the luxation is reduced, the shoulder is to be brought forward, and the elbow backward, to prevent the external extremity of the clavicle from going forward and being again displaced. The manœuvres of which we have been speaking are applicable to luxation backward and upward ; with this difference, however, that, in the first case, after having disengaged the internal extremity of the clavicle by extension, the shoulder is to be forcibly carried backward, and, in the second, it must be carried upward.

As soon as the bones are left to themselves, the extremity of the clavicle abandons the cavity of the sternum, and the luxation is re-produced. Desault's apparatus prevents, for a time, a recurrence of the luxation; but it quickly gets loose ; the clavicle eludes its action, abandons the cavity of the sternum, and remains always more projecting than that of the opposite side. The pain, however, dissipates, the torn ligaments consolidate, motion gradually becomes easy, and the limb soon recovers all its functions.

Although Desault's bandage for fractures of the clavicle has no other advantage in luxation of the external extremity of this bone than to render the deformity less, still it ought not to be neglected. It is necessary to renew it frequently, and to apply thick compresses on the internal extremity of the clavicle, which are to be kept on by several turns of the bandage. This bandage ought to be kept on until it is judged the ruptured ligaments are consolidated, which seldom takes place until the fortieth or fiftieth day.

From what has been said respecting the reduction of luxation of the internal extremity of the clavicle, and the proper means of keeping it reduced, it will be seen, that the figure of 8 bandage, and other methods recommended by several authors, are useless : all these means act like the cause that produced the luxation, and, therefore, cannot be of the least advantage.

ARTICLE II.

Of Luxations of the Humeral Extremity of the Clavicle.

Luxations of the external extremity of the clavicle are very rare, because that part is strongly united with the scapula, and these two bones always move together and in the same direction, whether the shoulder be elevated or depressed, carried forward or backward.

Most authors have admitted two kinds of luxation of the external extremity of the clavicle—one upward, the other downward. J. L. Petit says, that, although he has seen very few luxations downward, he thinks they ought to happen more frequently than luxations upward. On the contrary, it appears to us, that the obliquity of the articular surfaces, and the resting point which the base of the coracoid process offers to the clavicle, must render a luxation downward very difficult, if not impossible: and our reasoning on this point accords with experience. A great number of facts attest the possibility of luxation upward, and there is not one to prove that of luxation downward.

Almost all cases of luxation of the humeral extremity of the clavicle upward have been occasioned by a fall on the point of the shoulder; for when a man falls on this part, the weight of the body presses the scapula violently downward [towards the feet]; at this instant a mechanical instinct causes a contraction of the muscles of the shoulder, the action of the trapezium draws upward the clavicle with the greater effect, because the lever it presents has its fulcrum near the sternum, and, consequently, at a distance from where the power acts. This luxation, then, is the effect of two powers, one of which pushes the scapula downward, while the other draws the clavicle upward. But these two powers cannot produce the displacement unless they act with sufficient force to break the ligaments that surround the articulation, and even a part of those that unite the clavicle to the coracoid process.

The soft parts that cover the joint have so little thickness, that it is very easy to discover this luxation. A projection, formed by the humeral extremity of the clavicle, is felt beyond the level of the acromion; the facility with which this projection disappears, by drawing the shoulder outward and pushing the arm upward, and pressing, at the same time, on the extremity of the clavicle; a pain, more or less violent, increased by every movement of the arm, and particularly

by that of elevation—such are the signs that characterize
this luxation. The most remarkable of all is the projection
formed by the humeral extremity of the clavicle. These
signs are so evident, that it must be from want of attention if
they are mistaken. J. L. Petit says they were mistaken for
a fracture of the clavicle. Ancient authors attest their hav-
ing been frequently taken for luxation of the humerus. Hip-
pocrates speaks of them in his treatise *De Articulis.* Galien
has himself suffered by a similar mistake—" I have myself
experienced," says he, " that the clavicle, when luxated,
may approach the acromion; for when it was forcibly com-
pressed by the bandage, it descended very low. I supported
the inconvenience of this bandage forty days; the re-approxi-
mation of the bones was such, that those who had seen them
separated by an interval of three fingers breadth were struck
with admiration; and those who had not seen them in that
state could scarcely believe they had been luxated." Exten-
sion and counter-extension were first made, under the idea
that the humerus was luxated; but after submitting to this
treatment for some time Galien discovered the nature of this
accident. This case is remarkable from the enormous sepa-
ration of the bones, and the promptitude of the cure without
deformity.

It is difficult to conceive how the bones could be sepa-
rated three fingers breadth. We know, in this luxation,
the inferior surface of the humeral extremity is resting upon
the superior surface of the acromion, and the projection it
forms is always proportioned to its thickness. As to the cure,
how shall we persuade ourselves that it was perfect in forty
days, without leaving any trace of the accident, when it is de-
monstrated by experience, that, however great the attention
in the treatment, there always remains more or less defor-
mity. Are not these considerations proper to raise doubts as
to the nature of the accident that happened to Galien? It is,
however, certain, that luxation of the external extremity of
the clavicle upward has been frequently mistaken for a luxa-
tion of the humerus; and what may occasion this mistake is
the depression under the projection formed by the extremity
of the clavicle, which may be confounded with that which
takes place under the acromion in luxation of the humerus.
But in luxation of the clavicle the arm preserves its natural
direction, and the head of the humerus is not found in the
axilla.

The reduction of this luxation is very easy. It is only ne-
cessary to draw the shoulder outward and elevate it, while
we press the end of the clavicle to the internal and superior

part of the acromion. Although it is easy to reduce this luxation, it is very difficult, or almost impossible to keep it exactly reduced. The very small extent of articular surfaces, their obliquity, and the torn ligaments do not admit the slightest movements of the shoulder without again displacing the bone.

The means proper to keep this luxation reduced must act in the same manner as those that effected the reduction ; that is to say, they must lower the humeral extremity of the clavicle, raise the scapula, carry it outward, and keep the arm fixed against the body. Desault's bandage for a fracture of the clavicle so modified that, after having placed the long and thick compresses on the humeral extremity of the clavicle, the turns of the bandage pass under the elbow, and alternately over the affected and opposite shoulder, is best calculated to fulfil the indications. This bandage, however, like all other linen ones, has the inconvenience of becoming loose, and, in this case, the shoulder and the arm not being supported, the scapula descends, and the articular surfaces lose their natural relations. It is doubtful if any means have yet been discovered capable of curing this luxation without more or less deformity, which, however, does not injure the functions of the part.

CHAPTER XXX.

Of Luxations of the Arm.

OF all the bones in the body the humerus is that which is most easily and most generally luxated.

We shall easily see the reason of this, if we reflect upon the manner in which it is articulated with the scapula. A prominence, forming about the third of a sphere, situated at the upper extremity of the humerus, and directed backward and inward, is received into a superficial cavity, of an oval form, at the anterior angle of the shoulder blade. The extent of this cavity, although increased by a fibrous ring, is much smaller than the head of the humerus; so that, in whatever position the arm is placed, the largest part of this eminence is without the cavity, and embraced by the capsular ligament. This ligament, thin and loose throughout its whole extent, and especially at its inferior part, is rendered thick and firm above, by an accessory ligament, arising from the coracoid process. This formation of the joint gives to the humerus great facility in performing varied and extensive motions, but, at the same time, renders it less firm, and more liable to luxation. Nature has endeavoured to obviate this inconvenience by several means:—1st. The coracoid and acromion processes, and the triangular ligament, which extends from one to the other, form over the joint a kind of vault, which receives a part of the head of the humerus, and retains it when the arm is pushed upward. 2d. The glenoid cavity of the scapula being of an oval shape, with its greatest diameter in a vertical position, the elevation of the arm, a movement in which luxation takes place, may be carried very far without the head of the bone ceasing to rest upon this cavity. 3d. The tendon of the subscapularis muscle within or in front, that of the supra-spinalis above, those of the sub-spinalis and teres-minor without or behind, adhere strongly to the capsular ligament, are identified with it, and, moreover, bound together by a dense cellular tissue, so as to form a very solid covering, calculated to oppose, to a certain degree, luxations of the humerus in the parts to which they correspond. 4th. The movements of the arm do not take place altogether in the articulation of the humerus and scapula, but depend, in a great measure, upon the mobility of this last bone, which follows the motions of the humerus, so that, in the greatest motions of the arm, the humerus is rarely inclined to the scapula to

such a degree as to produce luxation. Notwithstanding
these circumstances, calculated to enable the articulation of
the humerus to resist the violence to which it is exposed,
it is very frequently dislocated : as often as all the other
bones of the body.

Almost all authors have written very vaguely upon luxa-
tion of the humerus ; the inaccuracy, ambiguity, and di-
versity of their language, not only render their descriptions
unintelligible, but show very plainly that the greater part of
them have not taken nature for their model, and that they
speak of things which they have never seen. It would be
easy to prove this proposition by a critical analysis of the
doctrine of the ancients and moderns upon this point of Pa-
thology ; but this would lead us into too long details, and
would add nothing which is essential to know on this subject.
We shall only remark, that Hippocrates is much nearer the
truth than those who have followed him. He does not deny
the possibility of every kind of luxation except that in which
the head of the humerus passes down into the axilla; but
he declares that he has seen no other.* although he must
have had frequent occasions to witness this accident. In fact,
this kind of luxation is the most common, and it is not rare
for men to see no other in the course of a long practice.

The arm may be easily carried backward, so as to form an
acute angle with the glenoid cavity, and, if it has been forced
in this direction by external violence, it may be luxated
toward the internal side of the shoulder blade. This kind of
luxation is much more rare than the first ; and it appears
that the resistance of the tendon of the sub-scapularis mus-
cle prevents its frequent occurrence. A study of the causes
which produce luxation of the arm will furnish other reasons
for this difference.

An opposite movement of the arm—that in which it is car-
ried forcibly toward the anterior part of the chest, by direct-
ing the head of the humerus outward and backward, may
throw it into the fossa sub-spinalis. The possibility of this
luxation was long admitted without proof, then rejected,
or considered as extremely doubtful. Judging from a sin-
gle example, we find it is strictly possible, but very uncom-
mon, since two or three cases can alone be cited. It appears
probable, therefore, that a particular preternatural forma-

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* "Humeri verò articulum uno modo luxari novi, ad locum sub alis. Sursùm autem
nunquàm, neque ad externam partem. Non tamen affirmaverim an luxetur aut
non, etiamsi habeam quod dicam de ipso. Sed neque in arteriorem partem unquàm
vidi, neque videtur mihi unquàm excidisse . . . Nunquàm vidi in anteriorem partem
elapsum ; non tamen affirmárim ne de hoc quidem an ita excidat, nec ne." Hippo-
crates De Artic. ex Vers. Venderlinden. No 1

tion of the joint has favoured the luxation,* and that the body hardly permits a motion of the arm forward great enough to allow all the necessary inclination of the articular surfaces to each other.

As to luxation upward, if we understand by it that the humerus is carried directly between the acromion and coracoid processes, it is evidently impossible, without a simultaneous fracture of the apophysis, and the corresponding extremity of the clavicle: but under this denomination has been described a luxation in which the humerus is carried below the clavicle, and on the internal side of the coracoid process. This luxation, considered as an immediate effect of external violence, has never been observed: it may, however, take place, but by another mechanism, which we are going to explain.

When the head of the humerus has escaped at the inferior part of the articulation, as most generally happens, it rests upon a surface of very small extent: further exertions of the patient—new impulses in whatever way communicated, carry it inward. So, after the head of the humerus has escaped at the internal side of the joint, whatever tends to bring the arm toward the body, may increase the extent of the dislocation, and carry the head of the humerus near the clavicle, below or to the inner side of the coracoid process. Thus we see that luxation of the humerus upward never takes place except consecutively, and after a primitive luxation inward ; and, though this last sometimes occurs primitively, it may also occur consecutively. These remarks are important, and may greatly influence our attempts to effect a reduction of a luxation downward.

Luxations of the humerus are almost always produced by a fall, in which the elbow, being separated from the body, is pressed against a solid plane. Under these circumstances, the elevation of the arm is carried as far as the disposition of the articular surfaces will allow, and much further than the action of the muscles can carry it ; the humerus is pushed forcibly against the glenoid cavity, and forms with it an acute angle, the point of which is turned downward ; the head of the bone is driven against the lower part of the

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* We have seen, in a subject, a singular inclination of the glenoid cavity backward. It extended, also, to a great length in that direction, so that the humerus could easily be carried into the fossa sub-spinalis. The subject, whose case has been published in the Journal de Medicine, vol. x. p. 586, and which we saw with M. Fizeau, had a luxation of the arm outward or backward, which was re-produced with great facility. This particularity is astonishing in an accident of so rare an occurrence. Was it not caused by a preternatural structure of the joint?

capsular ligament : if this ligament is lacerated, a luxation downwards takes place. But this last effect would rarely follow if the muscles which bring the arm to the body did not aid in producing it. They act in this way : when a person falls upon his side, his first motion is to put out his arm to prevent his head from striking the ground ; thus the whole weight of the body is received upon the arm, and as the pectoralis major, the latissimus dorsi and teres major contract strongly to sustain the body, and thus draw the arm towards the breast, they carry the head of the humerus out of its cavity : because the elbow is resting upon a fixed point, while the upper part of the bone remains moveable. Luxation of the arm is then the result of external violence, and the sudden and strong contraction of the pectoralis major, the latissimus dorsi, and the teres major. The effect is more certain, as these muscles are inserted near to the head of the humerus, which thus becomes the moveable point of a lever of the third kind.

Muscular action alone may produce luxation of the humerus downward. An example of this kind is cited, in which dislocation occurred during the exertion of lifting a burden to a considerable height, and the dislocation has been said to arise from the compression of the head of the bone by the deltoid muscle. But if we call to mind the elaborate remarks of Winslow on the simultaneous action of the antagonist muscles, we shall readily see how the pectoralis major, the latissimus dorsi, and the teres major, concur with the elevators of the arm to produce its luxation. The same mechanism must have taken place in another case, of which we have an account, where the humerus was almost uniformly dislocated at every accession of epileptic fits : the convulsive state of the muscles producing extreme elevation of the arm, which occasioned the head of the bone to slip out of the lower part of the cavity.

When the arm is raised, so as to almost form a line with the axis of the body, and, at the same time, carried backward, a fall upon the side may increase the inclination of the humerus to the articular surface, and push its head against the internal part of the capsule, by breaking which it becomes dislocated in this direction. In this case the resistance of the ground acts very obliquely upon the elbow : thus a great part of the effort is lost, and hence luxation is much more uncommon than in the former case. Another cause of this difference is, that the muscles can hardly contribute to this kind of luxation, on account of their direction in relation to the bone.

A fall upon the side, while the arm is carried strongly forward and upward, may cause a dislocation outward or backward. But to produce this effect the resistance of the elbow must be great enough to overcome the obstacle which the trunk opposes to a movement of the arm sufficiently extensive. In this case the humerus, resting upon the side of the chest, and having this point of support, it becomes a lever of the first kind, and is thus displaced outward. It is the opposition of the two movements of the humerus and scapula that ruptures the external part of the capsule, and dislodges the head of the bone. In this case the muscles have no concern in the dislocation, and for this reason it is so rare.

It is not yet proved that the three kinds of primitive luxation of the humerus can be caused, at least in their simple state, by external violence applied to any other than the lower extremity of the arm. There are many examples of luxation, produced by violence, acting upon the prominence of the shoulder; but in all these cases there was, at the same time, a fracture of the scapula, or of the humerus.*

As to displacements which take place consecutively to one of the primitive luxations of which we have spoken, the causes which produce them are the weight of the arm, which constantly tends to bring it near the trunk, and in a vertical line; the action of the muscles, which contract on account of the irritation produced by the luxation; external impulses, and other causes.

In the luxation downwards, as the head of the humerus rests upon an oblique and small surface, the action of the muscles which pass over the joint, and especially of those which the luxation has put upon a stretch, cause the bone to slip inwards, and produce a consecutive luxation in that direction: So in luxation inwards, the head of the humerus being lodged in the anterior part of the fossa sub-scapularis, this part of the shoulder-blade can oppose no resistance to the displaced bone, and the muscles easily draw it up.

No one can doubt that the capsular ligament is uniformly broken who considers its thinness and want of strength. We have had many opportunities of observing, by dissection, the size of the opening, which is always larger than the head of the humerus—sufficiently large to allow of the return of

* A case of this kind has lately been communicated to us by Mr. Houzelot, Physician at Meaux. The luxation took place outwards; but there was, at the same time, a fracture of the neck of the humerus. We have two drawings of this case, remarkable on account of this last circumstance, done by one of our pupils.

the bone without offering the least impediment. In luxation
downwards, we have seen the head of the humerus lodged be-
tween the long head of the triceps and the sub-scapularis, and
resting upon the internal border of the scapula. In luxa-
tion inwards, we have seen, after dissection, the head of
the humerus between the sub-scapular fossa, and the muscle
of the same name. In one instance we have seen the fibres
of this muscle separated, partly torn, and so disposed as
to admit the head of the humerus in the interval between
them, which, no doubt, would have entered had the pati-
ent lived. In this case the violence had been very great,
the patient having fallen from a considerable height ; and it
is easy to conceive that great violence is necessary to impel
the head of the humerus between the sub-scapularis and ser-
ratus major, as some authors have described this accident.
Cases of luxation inwards have occurred with fracture of the
upper part of the humerus, when the inferior portion had
torn the sub-scapular muscle. In these instances the pas-
sage of the head of the bone between this muscle and the
serratus major must be very easy. But in consecutive dis-
location upwards, consequent upon a simple luxation in-
wards, it is not easy to conceive how the head of the hume-
rus can be lodged under the pectoralis major, between the
sub-scapularis and the serratus magnus. In order to pass un-
der the inferior edge of the sub-scapularis, and to get within
this muscle, the humerus must rotate, which action the
other muscles oppose : if the bone penetrate the sub-scapu-
laris, and reach the serratus magnus, it must, of necessity,
afterwards approach the clavicle ; lastly, it must pass be-
tween the muscles in question and the shoulder-blade, and if
the bone be raised so as to approach the clavicle, this muscle
must follow it, and constantly cover its internal side. Some
authors speak of ruptures or displacements of the long head
of the triceps. To one of these two circumstances have
been attributed certain pains in the joint, remaining after
reduction of the bone, and which have ceased after moving
the arm in certain directions. We know of no anatomical
fact upon which this notion is founded, and we have dissected
many luxated arms without discovering any injury of this sort.

The signs of luxation of the arm are numerous and strik-
ing : In luxation downwards, which is most common, the
arm is somewhat lengthened, as we may discover by look-
ing at the patient from behind, and comparing the two el-
bows, while the forearm is flexed ; the arm is directed
outwards, and the elbow removed some distance from the
body. If we look steadily at the patient, either from before

or behind, and prolong in our minds the axis of the humerus, we find that it falls, not on the centre of the shoulder, as it should do, but a little below, and within the inferior angle of the scapula. The shoulder will have lost its spherical form. In the natural state the upper third of the external side of the arm presents a surface, more or less convex, according to the size of the deltoid muscle. If we pass our fingers over this part, and press a little, we feel the humerus. When luxation has taken place, this surface is flat, and forms, with the rest of the external side of the arm, a well marked angle, and our fingers will hardly feel the resistance of the humerus. This is produced by the tense state of the deltoid muscle, whose points of attachment are removed further from each other; and the acromion, being no longer supported by the head of the humerus, appears more prominent than natural. This part of the shoulder, in place of its natural round form, presents a depression that corresponds to the glenoid cavity which the humerus has left. In the axilla is felt the projecting head of the bone, situated below the neck of the scapula. The triceps and coraco-brachialis are tense, the forearm moderately flexed, or kept so by the patient himself, to whom either flexion or extension would give great pain. The scapula is inclined outward, and its anterior angle drawn back by the tension of the deltoid, coraco-brachialis, and triceps muscles, and by the weight of the arm, which tends to bring it nearer to the body. This inclination of the shoulder, and the pains which attend it, cause the patient to bend his head and body to that side, and to support the arm with the other hand. Spontaneous motion of the arm is lost, but, by taking hold of the elbow, we may carry it a little outward without causing much pain. Every other movement is excessively painful, especially that which brings the arm near the body.

In luxation inward or outward, the arm preserves its natural length, or is a little shortened; and the forearm is not fixed in a state of demi-flexion, because the muscles are less stretched.

In luxation inward, the arm is pointed outward and backward. The flattening of the shoulder, and the depression formed by the articular cavity, are not very apparent, except at the posterior part. The head of the humerus may be felt as well below the coracoid process as in the axilla, or it is plainly perceived within the neck of the scapula. The movement of the elbow forward is most painful, and vice versâ.

In luxation outward, on the contrary, the arm is pointed

inward and forward. The deformity of the shoulder is most remarkable at its anterior part. The head of the humerus, which cannot be felt in the axilla, forms a projection at the external anterior angle of the scapula, below the spine of that bone, and the base of the acromion process.

When the head of the humerus is placed below the clavicle, and near that bone and the coracoid process, it is evident that the luxation first took place on the internal side of the joint; but it is only some time after a luxation that the muscles or other causes can effect a consecutive displacement. But this never happens after the inflammation has augmented the thickness and consistence of the soft parts around the luxated bone.

But when the head of the bone of the arm is placed on the internal side of the glenoid cavity of the scapula, how is it to be known whether the humerus escaped by the internal side, or by the inferior part of the articulation. and, consequently, if its situation be the immediate effect of a luxation, or arise from a secondary displacement, in consequence of a luxation downward? It is not always possible to learn from the patient what was the attitude of the arm when the fall happened. An ecchymosis on the internal part of the elbow may furnish some idea of it; but it requires so violent a fall to leave a mark of this kind, that should it not exist, no negative conclusion ought to be formed. Is it not very probable, that the impossibility of distinguishing between a primary and a consecutive luxation inward, has occasioned the difficulty of reducing, even by a methodical process, some recent luxations.

In a luxation downward, and sometimes even inward, when the pain is slight and of short duration, the humerus soon experiences a new displacement. In the first place it passes inward, and, in the second, upward. The irritation produced by the first displacement is augmented by the second, and occasions a severe inflammation, that fixes the bone in its new situation: resolution, however, takes place, and the muscles, having recovered all their contractile powers, give more or less latitude and facility to the movement of the bone. Raising the arm is always the most easy and extensive movement; that of bringing it near the body is more difficult, from the resistance of the deltoid muscle: the most difficult is that of carrying the arm in front of the breast, or toward the head or the back. These two last movements are almost entirely lost.

To judge from the apparent ease with which the arm is moved before a luxation of the humerus has been reduced,

it would be thought the bone had acquired an advantageous situation by the displacement, and that the changes experienced by the muscles was of little importance. It has even been asserted, probably from the foregoing observation, that the scapulo-humeral articulation was that, of all others, where an anchylosis most seldom occurred, as a consequence of an unreduced luxation. But the fact is, almost all the movements of the arm depend on those of the scapula; the humerus contributes very little to them; and the movements of the humerus upon the scapula are very restricted after an unreduced luxation, but the great facility of moving the scapula allows the limb considerable latitude of motion.

Luxation of the arm is seldom followed by any serious consequences, unless it be complicated with violent contusion or fracture, or improper and unsuccessful attempts at reduction have been made. Sometimes, however, it happens that the violence which produced the luxation occasions inflammatory swelling of the joint and the surrounding parts; but this is dissipated by relaxing applications, provided a reduction is not persisted in, while the joint is in this state.

Although the disorder of the soft parts that accompanies luxations of the humerus is inconsiderable, and is generally confined to the tearing of the capsular ligament, and the contusion of the neighbouring parts—although the inflammation occasioned by it is generally slight, and although the distended and lengthened muscles become soon accustomed to these changes, and the natural movements of the limb are soon re-established:—still a luxation of the humerus becomes not less rapidly irreducible if not effected at an early period; it can seldom be accomplished after a month or six weeks. It is true, we have reduced a number of ancient luxations of the arm, and there are examples of others that have been reduced at more advanced periods. Yet experience has demonstrated that it is not less dangerous to mistake the accident in this case than when any other joint is affected, and that when time has been allowed for inflammation to fix the parts in an improper situation, the reduction becomes as difficult as in any other case.

It is evident, from what has been already said relative to the general principles of the reduction of luxations, that extension and counter-extension are essential in those of the humerus. The first of these ought to be applied to the wrist, and the second to the scapula, so as to prevent it from yielding to the force which stretches the arm; the direction of the extending force ought to bring the limb back to the attitude it had when the luxation took place; so that the mem-

ber must not be brought to its natural position until the head
of the luxated bone is conducted opposite to the articular
cavity of the scapula.

The patient is to be placed on a chair of ordinary height:
this is the most favourable position, because the body and the
limb are thus completely isolated. which gives a facility to
the reduction. Should any impediment to the reduction arise
from the patient's pressing his feet forcibly on the ground,
he may be laid on a table or bed, in a horizontal position.

The patient being thus placed, a napkin, or table-cloth,
should be laid in folds four or five fingers wide, and the mid-
dle of it applied to the back of the wrist, and the ends twisted
on the palmar side: these ends are to be acted upon by the
assistants.

A pad of an oblong form, large enough to extend beyond
the great dorsal and pectoral muscles, must be placed in
the arm-pit. A band, similar to the former, serves for coun-
ter-extension: the middle of it is placed on the pad, and one
of the extremities conducted obliquely in front, and the other
behind, then crossed and twisted on the sound shoulder; the
ends of this band are used by the assistants to resist the force
of the extension.

A folded napkin is used to retain the superior part of the
scapula; the middle of it is to be placed on the prominent
part of the acromion process, and one of the ends brought
obliquely in front, the other behind, toward the lower and
opposite side of the thorax. The ends of this last band
must be held by an assistant, behind the patient. Finally,
another assistant must prevent it from slipping, by pressing
the palm of his hand against it.

The scapula being extremely moveable, and suspended in
the middle of the muscles that surround it, if the counter-
extension were made by the bandage placed in the arm-pit,
as it bears only on its inferior angle, the extending force im-
parted to this bone by muscles surrounding the joint, and
particularly by the deltoid muscle, would give it a rotatory
motion, by which its anterior angle would be carried down-
ward and outward, and the inferior angle backward and out-
ward. To avoid this inconvenience, a second bandage is
placed on the acromion, by which the scapula is fixed.

The extending and counter-extending powers being thus
disposed, the operator places himself on the external side of
the limb, and the assistants charged with making the coun-
ter-extension, ought to draw in the direction in which the
bandages have been placed; but those charged with making
the extension ought first to place the limb in the position it

had when the accident happened ; and when the head of the
humerus is on a level with the glenoid cavity, gently bring
the limb to its natural situation, without discontinuing the ex-
tension. During this process, the operator should push the hu-
merus in a direction contrary to that in which it was luxated.

When the luxation takes place downward, the extension
should be made directly outward. The limb is then to be
brought downward, and a little forward, until the arm touches
the side. The surgeon ought to direct the movement by
which the assistants change the direction of the limb, and
extend it; as the wrist is lowered, he must press his body
against the external part of the elbow, and with his hands
placed on the internal and superior part of the humerus,
carry the head of this bone upward and outward. The suc-
cess of this operation depends on the unison, and just propor-
tion of the force of the extension and counter-extension, with
the movement given to the limb by the operator himself.
When luxation takes place inward, the extension ought to be
made horizontally outward and backward, after which the
limb is to be brought forward and downward, until it rests
obliquely on the anterior part of the breast ; but, before the
arm arrives at this point, the surgeon ought to act with one
hand on the posterior part of the elbow, and with the other
on the anterior and superior part of the humerus, so as to
bring the head of this bone outward, and thus conduct it into
the glenoid cavity.

When luxation takes place outward, the last manœuvre
must be made in an inverse direction, and the extension ought
first to be made, so as to direct the limb horizontally outward
and forward. The head of the bone is then to be conducted
outward, downward, and backward.

If a primary luxation happen downward, or inward, or a
consecutive displacement of the bone have carried it inward
or upward, the operator ought first to carry the head of the
humerus down into the arm-pit, and thence into the glenoid
cavity, by its inferior part, where the capsular ligament has
been torn.

When a luxation of the humerus is reducible, the simple
means of which we have been speaking will generally suc-
ceed, if proper care be taken to proportion the force of the
extension and counter-extension to that of the muscles around
the joint.

When a luxation is reduced, the pain ceases, or consider-
ably diminishes, the limb recovers its natural form, and can
execute all its natural movements ; it is, however, prudent
to abstain from moving the bone, except to ascertain if the

reduction be effected, and particularly to avoid giving it that movement by which the accident happened; otherwise we risk augmenting the irritation, and even occasioning a new displacement, as once happened to ourselves.

The humerus cannot be luxated, unless the arm be separated from the body, and more or less raised. To keep it in its place after it is reduced, the arm should be confined by means of a band around it and the body, or a band around the body and the arm respectively. The bandage should be applied near the elbow; the shoulder is to be covered with compresses wet with resolvent liquids; the arm to be continued pressed against the body eight or ten days, after which it may be supported by a sling. As soon as the pain is dissipated (which will be according to the degree of contusion and irritation of the soft parts) the limb should be moved to prevent its contracting a stiffness from remaining a long time in the same position. These movements should be gradually augmented until the stiffness is entirely removed.

Luxation of the humerus may be complicated with inflammation, edematous swelling, and palsy.

Luxation of the humerus is seldom attended with much inflammation, unless in the fall which occasioned the luxation, and the shoulder has been bruised; in which case, if the swelling be so considerable as to prevent the reduction, we should endeavour immediately to dissipate it.

After a luxation of the arm, particularly if it be of long standing, an edematous swelling of the limb sometimes appears, which denotes a difficulty in the circulation of the lymph, arising from a pressure on the veins and lymphatics. It rarely occurs to a great degree, and is seldom seen in recent luxations. It soon diminishes after the reduction of the luxation. Should it, however, continue, a methodical and regular compression of the whole length of the limb will dissipate it.

Palsy is a much more serious complication. It is occasioned by the compression and contusion of the nerves that form the brachial plexus, by the head of the humerus when it escapes from its cavity. On reflecting on the situation of this plexus, we might be surprised that this accident does not more frequently happen, did we not consider that the muscles which surround the joint do not permit an extensive displacement, and that the form of the head of the humerus occasions it to slide on the brachial plexus, and on the axillary vessels, by which they escape a strong pressure. In some cases, this pressure extends to all the nerves that form the brachial plexus; then all the muscles of the arm and fore

arm are paralyzed. In other instances, it is confined to the circumflex nerve. whose spinal direction over the internal part of the humerus renders it more susceptible of this compression than the other nerves. Desault twice saw all the muscles paralyzed in consequence of a luxation of the arm.

In one of these cases the palsy resisted all the efforts of art ; in the other, irritating liniments restored the contracting power of the muscles at the end of sixteen days. We have three times seen the deltoid muscle paralyzed after luxation of the humerus downward. In one of these cases it lost all contractile power, became much thinner, and the patient was unable to raise the arm.

Paralysis of all the muscles of the arm is to be feared after a luxation of the humerus. if, immediately after the accident, the patient feel a numbness and coldness in the limb ; and if the hand and arm cannot make the natural movements, no doubt can exist of its existence. It is not so easy to distinguish paralysis of the deltoid muscle, because the patient does not experience any sensation about this muscle, which might lead us to presume the circumflex nerve has been bruised and disorganized. It is not until after the cessation of the pain permits the voluntary movements of the limb that we can be certain of its existence.

If, after a luxation of the humerus, paralysis be apprehended, or have actually taken place, recourse must be had to irritating applications, such as the tincture of cantharides alone, or mixed with the balsam of Florence, volatile liniments, &c. But if they prove insufficient, we must apply blisters, and even moxa, placed above the clavicle, on the brachial plexus. All these means may be of use, when the nerves have but slightly suffered ; but are without effect if these organs have been violently contused and disorganized.

We shall close this chapter by mentioning a singular accident. mentioned by Desault, which happened at the moment of the reduction of a luxation of the humerus : A man, aged sixty years, had the left arm luxated forward for a month and a half; to reduce this luxation, Desault was obliged not only to renew several times the extensions and counter-extensions, with great force, but likewise to move the limb forcibly upward, forward, and outward, with a view of destroying the adhesions. Scarcely was the reduction completed, when a tumour suddenly arose under the great pectoral muscle, extending to the hollow of the armpit, which soon acquired the size of a man's head. This extraordinary phenomenon astonished Desault, and all the assistants. This practitioner was a little embarrassed at first.

and thought the artery was ruptured, but seeing none of the characteristics of an aneurismal tumour, he judged that it was occasioned by wind collected between the broken cellules of the cellular tissue.

Compresses wet with vegeto-mineral water were applied to the swelled part; compression was exercised with a bandage, and the arm was confined to the body.

The tumour gradually diminished, and at the end of thirteen days no vestige of it remained. In its place a large ecchymosis appeared, the resolution of which was completed in twenty-seven days.

CHAPTER XXXI.

Of Luxations of the Forearm.

UNDER this head we include, 1st, Luxations common to the radius and cubitus, properly called luxations of the forearm. 2d. Those of the superior extremity of the radius. 3d. Those of the superior extremity of the ulna.

ARTICLE I.

Of Luxations of both the Bones of the Forearm.

The elbow joint placed in the centre of the lever formed by the arm, must necessarily be exposed to the operation of considerable and varied forces; it, therefore, required much strength. The great breadth of the articulation; the reciprocal furrows on its surfaces, in antero-posterior direction, that represent a cylinder received in an analogous cavity, formed by the other; a number of alternate projections and cavities, disposed transversely to the joint, and restricting its movements; an articular capsule; two strong fibrous lateral ligaments; and, above all, numerous muscles, that cover the two sides of the forearm, and most of which give origin to two tendinous fascia which are inserted into the internal and external condyles of the humerus, and others form on each side of the joint a powerful barrier, capable of tension and resistance:—Such are the means by which

nature has protected the elbow joint from luxation. This joint presents, in its structure, and the disposition of the surrounding parts, some very remarkable circumstances. 1st. The olecranon embraces the posterior part of articular pully of the humerus, and renders a luxation of the forearm impossible, unless that projection be fractured. 2d. The external lateral ligament embraces the end of the radius, and confines it to the small sigmoid cavity of the cubitus; which explains why certain luxations of the forearm are complicated with luxations of the superior extremity of the radius upon the ulna. 3d. The joint being surrounded by muscles, no considerable displacement occurs, without a great injury to the soft parts. 4th. The situation of the brachial artery, the median, cubital, and radial nerves, on the lateral anterior part of the articulation, exposes them to serious injuries by the luxated bones.

Notwithstanding the strength of the elbow joint, the forearm is susceptible of luxation. either backward. forward. or laterally. A luxation forward is impossible, unless the olecranon be fractured; luxation backward is most frequent; those to one side seldom happen.

Luxation of the forearm backward can never be incomplete, if the end of the coronoid process be not pushed beyond the vertical diameter of the joint of the humerus. This last, from the obliquity of its surface, would fall into the great sigmoid cavity, when the force ceased. The coronoid process is brought, by a similar mechanism, into the cavity of the humerus destined to receive the end of the olecranon when it has passed the projecting point of which we are speaking.

Luxation of the forearm backward has been supposed to be produced by violent extension alone. Admitting this supposition, in which the end of the olecranon will be the centre of the movement described by the forearm, the triceps brachialis and internal muscles would be broken, which is not the fact. A number of instances are known. in which luxations of this kind have been occasioned by a fall forward. the palm of the hand resting on the ground, and the forearm being half bent. In this attitude, and the feeble efforts of extension which accompany it, the momentum of the body in the fall is transmitted entirely to the lower end of the humerus, which, not being supported by the anterior part of the capsule, and by the superior side of the coronoid process. that forms an inclined plane, must slip forward. and thus occasion a luxation of the forearm backward. In this position, the muscles have no agency in pro-

ducing the luxation, but merely retain the muscles in the at-
titude in which the displacement has taken place.

When we reflect on the extent of the articular surfaces, and
the distance they must go before their correspondence totally
ceases, it will be readily conceived, that all the soft parts
which surround them must experience extreme violence in a
luxation backward. The lateral ligaments are always bro-
ken; sometimes the annular ligament of the radius yields
sooner than the lateral external ligament, to the inferior ex-
tremity of which it is attached; the radius is then dislo-
cated from the small sigmoid cavity of the ulna and radius,
backwards. It is probable, if the inferior insertion of the
brachialis and triceps muscles, and particularly this last, did
not take place at a certain distance from the joint, they
would be frequently ruptured by the inferior extremity of
the humerus. This, indeed, sometimes happens; the joint
is then very moveable, and has no uniform position. The
humerus has been known to break the muscles and pierce
the skin. J. L. Petit mentions a case where a very fat lady
fell on the palm of the hand, and luxated the forearm back-
ward; the humerus perforated the skin, and the end rested
on the floor.

It is difficult to conceive how the median nerves, and the
brachial artery, in a case of this kind, can escape a rupture.
This artery has been torn in a similar case, and gangrene
terminated the life of the patient. But the disorder of the
soft parts is almost always restricted to the tearing of the li-
gaments; the inferior extremity of the humerus rests on
the anterior parts of the ulna and radius, directly under the
coronoid process; the joint is enveloped and supported by
the biceps and brachialis muscles that restrict the extent of
the luxation. These muscles, pressed out by the side of the
bone, are in a state of tension, and keep the forearm half
bent; the coronoid process of the cubitus is lodged in the
olecranon cavity of the humerus, and the olecranon process
is thrown backward and upward.

This luxation is easily known. The forearm is bent to a
certain degree,.according as the cubitus and radius have been
carried, more or less behind the inferior extremity of the
humerus. It is equally impossible to extend or bend it more,
and when attempted, the patient experiences violent pain.
Sometimes it, however, can be moved in any direction, which
indicates a considerable rupture of the ligaments. There is
a projection at the bend of the arm, formed by the inferior
extremity of the humerus. The olecranon, which, in the
natural state of the joint, and when the forearm is bent, is

on a level with the external condyle of the humerus, and under the internal, when a luxation takes place, is above the condyles, notwithstanding the flexion of the forearm. These changes, in relation of the olecranon to the condyles of the humerus, sufficiently characterize the accident, and therefore merit attention.

Another phenomenon sometimes deceives in this case; that is, a snapping, occasioned by the rubbing of the surfaces of the joint against each other, which may lead one to believe there is a fracture. Nothing is more important than to be assured of the existence of this luxation, for, if not soon reduced, it becomes irreducible; we should, therefore, examine the structure of the joint with great care, in every case in which it has been exposed to causes capable of producing this luxation. If swelling have come on, it will be proper to delay pronouncing an opinion, until, by a new examination, after it has somewhat abated, we are enabled to pronounce positively on the accident.

Luxation of the forearm backward, if discovered in time, is not a serious accident; the reduction is usually easy. But after a month or six weeks have elapsed, the reduction is generally impossible. We had the good fortune, notwithstanding, to reduce a luxation of four weeks duration, in a child ten years of age; but it is rarely practible at this late period, which is precisely that at which the inflammation has abated sufficiently to allow us to see the state of the parts. In some young patients, in whom this reduction is left unreduced, the pressure of the bones of the forearm upon the articular surface of the humerus changes its structure, but almost always the forearm remains fixed in a state of demi-flexion. The power of pronating and supinating the hand is entirely lost.

A mistake may be attended with consequences still more serious, if the biceps and brachialis anterior muscles are ruptered. In this case, there being nothing to counterbalance the action of the triceps, the forearm is extended; and if the luxation be not reduced, the joint becomes anchylosed in this position.

When a luxation of the forearm backward is accompanied by rupture of the anterior muscles, and the inferior end of the humerus pierces the skin, the case is very serious. The extremity of the humerus takes a very oblique direction, so that the opening of the capsular ligament, and that of the integuments, are far from being parallel. We have witnessed a case of this kind, and the accident was not so bad as might naturally be expected. The case observed by J.

L. Petit was more surprising, from the rapidity of its cure.
In this instance, the patient was completely cured (except a
little stiffness in the joint) in six weeks. False anchylosis
is greatly to be feared in accidents of this nature.

The worst case of all is, when the humerus, escaping from
the cavity formed by the bones of the forearm, tearing
every thing in its way, ruptures the brachial artery, with or
without breaking the median nerve. Although commonly
large ruptured vessels do not bleed, yet, in this case, if we
proceed to the reduction, it would be imprudent not to make
a ligature on the artery. Still it is more than probable that
the circulation will not continue in this situation, particu-
larly if the median nerve were ruptured. I saw a case of this
kind, in which the ligature was applied, and the luxation
reduced; but gangrene affected the limb, and the patient
died.

There are several methods of reducing luxations of the
forearm backward:—1st. The patient being seated, the
surgeon places one of his elbows on the anterior part of the
luxated joint, grasps the patient's hand between his, and
carries it toward the shoulder, pressing his elbow downward.
2d. The patient being seated on a post bedstead, the bent
part of the affected limb is placed round one of the posts;
the surgeon then seizes the shoulder and wrist, and brings
them toward each other, by a forcible flexion, the elbow be-
ing at the same time pressed against the bed-post. 3d. The
patient being seated, two assistants draw the limbs, one the
arm, the other the forearm, in a straight line, until the re-
sistance of the muscles is overcome, and the articular sur-
faces brought on a level; the surgeon then applies one hand
to the arm, and with the other takes the inferior part of
the forearm, and adds a violent effort of flexion to the ex-
tension already made. This process is more rational than
the two first; but the following is preferable to it.

The patient being seated on a stool, the surgeon places
the fingers of both his hands united on the bend of the arm,
and his two thumbs on the projection formed by the olecra-
non; he is then to push the inferior extremity of the hume-
rus backward, and the olecranon forward; two assistants
take, one the shoulder, and the other the wrist, and make
the extension and counter-extension; the surgeon uses his
fingers as already indicated: when he perceives the articu-
lar surfaces are near their natural situation, the assistant
charged with making the extension is ordered to draw the
forearm in the direction of its flexion.

In recent luxations, difficulties are seldom experienced;

frequently the fingers alone are sufficient, particularly when the anterior muscles have been ruptured. But in ancient luxations, the extension and counter-extension must be made by bands, disposed as in luxations of the humerus; and in this case, previous forcible movements must be given to the limb, to destroy or weaken the adhesions the parts have already contracted.

When the inter-osseous ligament of the forearm is not broken, the ulna, in returning to its natural place, draws the radius with it, and these two bones are reduced at the same time, although the force that effected the coaptation acted only on one of them. But when this ligament is broken, the ulna may be replaced without the radius ; or, if the two bones have been reduced at the same time, the radius may be again displaced ; and, should it remain in this state, pronation, and especially supination, would be impossible.

Although luxation of the forearm backwards soon becomes irreducible, still, when it is accompanied by very great inflammatory swelling, a reduction ought not to be attempted until this is dissipated, or considerably diminished. A contrary conduct may occasion serious accidents, of which there are many examples.

When a luxation is ancient, we must not persist in the reduction, after having ineffectually attempted it by proper means. However great the deformity, it is better to leave it than expose the patient to very serious accidents. We have never attempted it in similar cases, without seeing a violent inflammation follow the unsuccessful attempts.

When the extremity of the humerus penetrates through the soft parts, the reduction is not difficult. The patient ought then to be treated as for a complicated fracture. We know not, if a case of this kind (the patient being left to nature for several days) has been observed. It would certainly be a very serious case. We think, if the inflammatory symptoms were already developed, it would be wrong to attempt to reduce the luxation at this moment. We should desist from replacing the projecting bone until these symptoms were dissipated.

We have never had occasion to observe the terrible effects of a luxation complicated with an ulcer, the coming through of the humerus, and rupture of the brachial artery. We think it would be useless to attempt to save the limb. The violence of the shock, the disorder the parts have experienced, the prodigious swelling that must necessarily follow, would leave no hope of the circulation being continued in it, and amputation must immediately be performed.

This luxation is known to be reduced by the appearance of the parts, and the facility of flexing and extending the arm, &c. It is then necessary to assure ourselves if the radius was replaced at the same time with the cubitus; if not, it must be reduced immediately. The power of performing the movements of pronation and supination will show when it is in its natural place.

To keep this luxation reduced, the forearm being bent to a right angle, the joint is to be covered with long compresses wet with resolvent liquid, and kept in place by a figure of 8 bandage; the dressing is to be removed every two or three days, and at each time the hand is to be placed in a state of pronation and supination, to ascertain that the radius has preserved its natural position; should it have quitted it, and gone backwards, a splint must be applied along the posterior part of the radius, to prevent it from leaving the small sigmoid cavity of the ulna.

Emollient and anodyne poultices are employed when the luxation is accompanied with inflammation; and the dressing of which we have been speaking is not to be applied until the inflammation is dissipated. Movements of the limb ought to be made as soon as the state of the soft parts will permit, to prevent stiffness.

We have never seen a luxation of the forearm forward accompanied and complicated with fracture of the olecranon; and we doubt if this case, which has been conceived possible, has ever been observed. In such instances, we conceive the projection formed on the anterior and inferior part of the arm by the superior extremity of the bone of the forearm, would be remarkable, and the limb very moveable. It would be impossible for the inter-osseous ligament to escape being entirely torn; and it is extremely doubtful if coaptation of the two fragments could be effected. On the other hand, such an accident could only be produced by enormous violence. An inflammatory swelling, proportioned to the intensity of the luxating cause, must be expected. Thus contusion, or some degree of stiffness of the joint, being very probable, it would be prudent to pay no attention to the fracture, at least not to place the limb in a state of extension, in the vain hope of obtaining an exact reunion of the fragments. On the contrary, after having reduced the luxation, place the limb at a right angle, and keep it so by proper bandages, and bring the olecranon lower down; for if the forearm be like to lose its principal movements, it is essential to place it in a position in which it can be of some utility, which is that of flexion.

Luxation of the forearm on either side of the humerus is very rare, not only because the surrounding parts of the elbow joint are furnished with powerful means of union, but because the reciprocal depressions and projections of the articular surfaces prevent a displacement in this direction, and particularly because the forearm is not susceptible of any movement that can facilitate luxation of this kind. The forearm may, however, be luxated outward and inward; but the external violence capable of producing either must be very powerful, and act, at the same time, on the arm and forearm in contrary directions. J. L. Petit mentions an example of a servant that had the forearm caught in the spokes of a carriage in motion, and of another person who had the same part under the body of a horse that fell with him. Each suffered a lateral luxation of the forearm.

The great breadth of the joint renders difficult a complete lateral dislocation of the forearm. Luxation of this kind is generally incomplete. In the last case, the articular surfaces still touch, but their relations are more or less changed. In other instances, the bones are pushed quite beyond their natural contact; the luxation is then complete, and if the forearm have been carried outward, not being held by any of the ligaments, it is carried upward, and there is then a real overlaping of the forearm on the arm. The external condyle of the humerus has too little elevation to oppose this new displacement: But if, on the contrary, the luxation take place toward the internal side, this last effect does not follow; the bones of the forearm being supported by the internal condyle of the humerus.

There cannot be even an incomplete luxation of the forearm without a rupture of all the ligaments. Even the muscles of the forearm, that form two large and powerful packets, one on each side the elbow joint, may be broken near their insertion. On this account, the luxated limb is rarely so flexed as in luxation backward. This phenomenon never exists when the luxation is complete.

Very little attention is necessary to discover a complete luxation of the forearm, whether inward or outward; incomplete luxation, if of little extent, is more difficult to discover. However, the projection formed on one side by the radius or the ulna, and on the other by the opposite side of the extremity of the humerus; the depression above one, and below the other of these projections; the rising formed by the biceps and brachialis muscles before, and by the triceps behind the elbow; the inclination of the forearm and hand outward; and the feebleness and fixed state of the limb,

are sufficiently characteristic of the accident. If swelling have already taken place, the diagnosis may be more difficult, particularly if the displacement be trifling.

Complete lateral luxations are more serious than those backward, on account of the intensity of the cause necessary to produce them, and the consequent injury of the soft parts. Incomplete luxations are neither serious nor difficult to reduce. Should they not be reduced, the movements are more or less completely re-established, if care is taken to exercise them early.

Reduction of the luxations we are now speaking of, is never difficult, because the soft parts that surround the joint are torn; most frequently extension is not necessary to bring the bones to their natural situation; it is, however, prudent to extend the limb so as to prevent the bones from rubbing against each other during the coaptation. The patient should be seated, and the surgeon, placing himself on the internal or external side of the luxated limb, according as the luxation has taken place inward or outward, takes hold of the joint in such a manner that the fingers of each hand press against the lower extremity of the humerus, while the thumbs are applied to the upper part of the bones of the forearm; one assistant takes hold of the wrist, the second of the superior part of the arm, to make the extension and counter-extension in a straight line. When the luxation is not complete, slight extension is sufficient: but in complete luxation outward, the limb must be extended until it is restored to its proper length; and when this is effected, the surgeon presses the two bones of the forearm in opposite directions, until he reduces them. By bending the forearm, he can then judge, from the natural appearance of the limb, and the freedom of its movements, if the reduction is properly effected. He should then examine if the upper extremity of the radius preserves its natural relations with the ulna.

When the reduction is effected, the forearm should be bent to a right angle, and covered with compresses wet with a resolvent liquid. They are to be kept on by a roller moderately tight. The arm is then to be placed in a sling. If there is a great tendency to a recurrence of the luxation, splints of wood or paste-board should be applied. The inflammation is generally very violent, and requires a low diet, several bleedings, and the application of emollient and anodyne poultices. As soon as it has somewhat abated, we should move the bones gently, to prevent stiffness of the joint.

CHAPTER XXXII.

Of Luxations of the Bones of the Forearm from each other.

THE superior extremity of the radius may abandon the small sigmoid cavity of the ulna with which it is articulated; and the round head at the lower end of the ulna, may also escape from the sigmoid cavity of the radius, into which it is received. We shall treat of each of these accidents in a separate article, after stating some circumstances common to both.

The structure of the forearm is such as to permit the upper part of the radius to turn upon its axis, without preventing a slight lateral inclination, or the movements of flexion and extension. In the movements of pronation and supination, the hand turns in a circle, of which the styloid process of the ulna is the centre. The inner side of the lower extremity of the radius describes an arch of a very small circle; the outer side moves in that of a larger circle: hence the radius deviates very little from the natural direction of its axis; were it not for this the superior ligaments would be put upon the stretch, and would resist the movement of pronation.

In the prone position of the hand, its radial edge being turned forward and inward, the upper part of the radius is removed a little from the small head of the humerus with which it is articulated; on the contrary, where the hand is in a supine position, the radius is pressed against the humerus.

However, the flexor muscles of the fingers form, with the radius, a much larger angle than the extensor muscles. This will be evident, if we compare the situation of the pronator teres and pronator quadratus, with that of the supinator brevis, the only muscle which can limit excessive pronation.

Lastly, we make the strongest efforts to place the hand in a state of pronation, and it is during these exertions especially, that the forearm is exposed to dislocation.

ARTICLE I.

Of Luxation of the Upper Extremity of the Radius.

The upper extremity of the radius can only be luxated backward. This luxation is most frequent among children, because, in them, the ligaments and tendons of the extensor muscles are weaker, and the sigmoid cavity of the ulna is more superficial. It is always complete. The annular ligament is ruptured when the accident takes place directly from external violence. In some cases, however, of which we shall presently speak, the ligaments are merely stretched.

In several instances this luxation has been occasioned by a fall upon the hand unexpectedly caught in a state of extreme pronation; but it is most generally caused by external violence, tending strongly to pronate the hand: hence it occurs frequently in children who are lifted by the hand over a stream, or into the arms of another person; and, also, when they are taken by the hand in play. In these circumstances, the hand being generally pronated very suddenly, the luxation is either immediately produced; or, by repetition of this improper practice, the ligaments which connect the upper end of the radius with the humerus, become so much relaxed as to suffer the bone to be displaced.

This accident is attended with severe pain in the seat of the injury; the forearm is bent, and the hand remains fixed in a state of pronation; the patient cannot supinate the hand; if the surgeon attempt to supinate it, the pain is much increased; the hand and fingers are kept moderately flexed; and, lastly, the upper end of the radius forms a projection behind the small head of the humerus.

A relaxation of the ligaments of the articulation of the radius with the ulna is attended with the following symptoms: The articulation is evidently loose; the head of the radius projects more than it should, and there is pain and swelling about the joint. The children fear to have the part examined, and cry when the hand is pronated or supinated, when the arm is flexed or extended, but, above all, when we press upon the joint. If we offer them a play-thing, they put out the well hand to receive it: if we oblige them to take it with the other, and they wish to put it to their mouth, they bend the hand, and incline the head as much as possible. If the forearm is moved during sleep, they awake crying. The proper treatment in this case is to apply a rol-

ler, wet with a resolvent liquid, and to support the arm in a
sling. If this treatment be neglected, and the causes of the
relaxation are repeated, the end of the radius at length
abandons the sigmoid cavity of the ulna, distending or tear-
ing the annular ligament.

When this luxation is not reduced, though no serious con-
sequences ensue, the movements of pronation and supination
are, in some measure, impeded, and the hand is much less
useful than it would otherwise be.

In effecting the reduction, the patient should be seated on
a chair, and the limb held at a proper height by two assist-
ants; one of whom takes hold of the hand, the other of the
lower part of the arm. The surgeon, stationed on the af-
fected side, places the four fingers of one of his hands upon
the bend of the elbow, and the thumb upon the posterior
part of the projecting head of the radius; with the other hand
he takes hold of the patient's wrist. While in this situation,
the operator, and the assistant who has hold of the patient's
hand, acting in concert, bring the forearm to a state of su-
pination and extension, while the thumb of the former pushes
the head of the humerus into the sigmoid cavity of the ulna.
The sudden disappearance of the projection formed by the
head of the radius, and, in some instances, a noise, toge-
ther with the return of the forearm to a state of supination,
and the power of extending and bending it freely, are cer-
tain signs of the reduction of the luxation.

Children pronate and supinate the hand voluntarily, if we
take pains to induce them to make these movements; but we
should not carry our experiments too far, lest we re-produce
the luxation.

In order to prevent a return of this displacement, the
forearm should be flexed, and slightly supinated. The joint
is then to be covered with oblong compresses, kept on by a
roller moderately tight. The arm should be placed in a
sling, and a folded towel should be laid along the anterior
part of the forearm, to prevent the movement of prona-
tion.

When there is a marked tendency to a repetition of the
displacement, a splint of wood should be placed along the
posterior part of this bone.

After twenty days we may discontinue the use of the ap-
paratus.

In children, in whom we perceive the articulation to be
relaxed, we should forbid the nurse to force the forearm
to a state of pronation, by drawing upon the hand; or, if
necessary, even confine the forearm to the body, as after a
luxation.

ARTICLE II.

Of Luxations of the Inferior Extremity of the Ulna.

This accident has been improperly considered, by some authors as a luxation of the lower end of the radius.

Desault first proved the reality of this luxation. Facts in confirmation of his opinion have since shown, beyond all doubt, the possibility of this accident, which the Royal Academy of Surgery treated as chimerical. There are, in fact, two kinds of luxation of the lower extremity of the ulna; one backward, the other forward.

These accidents are much more rare than luxations of the superior end of the radius. The displacement backward is most frequent: we have met with only one instance of luxation forward.

Among the bodies brought to the amphitheatre for dissection, in 1793, Desault found one of whom no account could be obtained, who evidently offered an example of luxation of the inferior extremity of the ulna backward: A hard prominence was perceived before the lower end of the forearm, and a depression on the opposite side. The part was carefully dissected: The hand was edematous; the tendons of the flexor muscles, pushed outward, adhered to each other, and to the spine; the sigmoid cavity of the radius was filled with cellular substance; the inter-articular ligament, which is between the ulna and the os pyramidale, scarcely touched the ulna, and had followed the radius backward; the head of the ulna, situated before the sigmoid cavity of the radius, rested upon a sesamoid bone, to which it was attached by a capsular ligament.

Both these kinds of luxation of the lower end of the ulna are occasioned by external violence, applied to the forearm or the hand. Desault published the case of a washer-woman, who luxated the lower end of the ulna backward, in wrenching clothes. In cases of this kind, the capsular ligament, which surrounds the articulation of the ulna with the sigmoid cavity of the radius, is put upon the stretch, and exposed to laceration; the triangular ligament, which goes from the radius to the ulna, protects it, in some measure, by moderating this movement. In order that the luxation take place, this ligament must lengthen enough to pass behind the head of the ulna.

Some facts lead to the belief, that the lower end of the ulna may be luxated backward in a fall upon the hand.

In luxation backward, the forearm and hand are in a state of extreme pronation, and the two bones of the forearm evidently cross each other; the lower part of the forearm is much narrower than in its natural state; the forearm, hand, and fingers are fixed in a state of moderate flexion; the tendons of the flexor muscles, gathered into a bundle, project on the ulnar edge of the radius; the inferior extremity of this bone seems to be above the level of the wrist, but this is a deception which arises from the change in the situation of the radius and ulna. In luxation forward, we observe the same crossing of the bones of the forearm; the flexed state of this part, and of the fingers, and the narrowness of the lower end of the limb; the forearm and hand are fixed in a state of supination, the projection of the ulna is perceived in front, and the tendons of the flexor muscles are pushed outward; the inferior extremity of the ulna, instead of being parallel to the radius, is oblique, in a direction downwards, outwards, and forwards. In each case there is acute pain, extending from the articulation over the forearm, and greatly increased when the slightest effort is made to pronate the hand, or to extend the arm.

When the luxation is not reduced, the movements of pronation and supination are lost; the movements of the fingers are more or less embarrassed.

To effect the reduction, the patient is to be seated, and the limb supported by two assistants, as in the case of luxation of the superior extremity of the radius; the surgeon, stationing himself on the outer side of the limb, embraces the lower part of it with his hands, one on the ulnar edge, and the other on the radial edge, so that the thumbs may lie pressed into the interval between the two bones, on the side toward which the bone is displaced, and the fingers on the opposite side, and thus forces the bones in contrary directions; when he perceives that they are somewhat separated, he directs the hand to be supinated, if the luxation be backward, and pronated, if the luxation be forward; at the same time pushing the ulna back to its place. Repeated trials are often necessary before we can succeed in effecting the reduction.

After the reduction, it is very necessary to guard against a recurrence of the luxation, by laying thick compresses, and even a splint, along the ulna, extending to the hand.

Case. In 1791, a woman of strong constitution, but spare, having drank some wine, was looking over some persons at play, in a coffee-house, and making observations on the game. One of the players, a stout man, highly offended,

rose from his seat, took hold of her right hand, and endea-
voured to put her out of the room. In the struggle, the
woman's hand and forearm were forcibly supinated ; she felt
acute pain, and cried out that her wrist was broken. I saw
her immediately afterward : The forearm was bent, the hand
flexed, and in a state of strong supination ; the least attempt
to pronate the hand caused excruciating pain ; the head of
the ulna projected anteriorly ; the ulna formed a very acute
angle with the radius, passing downward, forward, and out-
ward. Convinced that the lower extremity of the ulna
was dislocated forward, I endeavoured to reduce it after
the manner I have laid down. The fourth attempt was suc-
cessful. The part was covered with compresses wet with
brandy and water, and a bandage passed two or three times
around them. The next day, some tendency to displace-
ment being discovered, a roller was carefully applied. This
treatment was continued for fifteen days ; the patient was
then permitted cautiously to use the limb. The cure was
complete.

CHAPTER XXXIII.

Of Luxations of the Bones of the Hand.

IN this chapter we shall treat, 1st. Of luxations of the
hand, or wrist ; 2d. Of those of the bones of the carpus ;
3d. Of those of the bones of the metacarpus ; and, 4th.
of those of the bones of the fingers.

ARTICLE I.

Of Luxations of the Wrist.

The three first bones of the carpus form a convexity, ob-
long, in a transverse direction, inclined backward, and re-
ceived into a cavity at the lower extremity of the radius.
The ulna forms no part of this cavity ; but the lower part of
the ligamento-cartilaginous substance, which passes from
the radius to the ulna, between the os pyrimadale and the
latter bone, forms the internal part of the cavity in question.

This articulation is strengthened by a capsule, two lateral
ligaments, and by the tendons of the muscles of the hands
and fingers. These tendons contribute greatly to prevent
luxations of the wrist, which are, consequently, rare.

Notwithstanding this, the wrist may be luxated, and in
four different ways, viz. backward, forward, inward, and
outward. The two first named are the most frequent, and
these luxations are generally complete; but the others are
almost always incomplete.

In all these luxations, the ligaments corresponding to the
side toward which the luxation takes place, are lacerated,
and the tendons are more or less distended. The most fre-
quent cause of these accidents is a fall upon the palm or back
of the hand, or upon the radial or cubital edge of it; or a
sudded and unexpected impulse, communicated to the hand
in the direction of its flexion, extension, or of its abduction
or adduction.

In whatever direction the luxation may take place, the
hand loses the power of moving, and the radius that of ro-
tating. Beside these characteristics, each particular kind
of luxation of the hand has its peculiar symptoms. 1st. In
the luxation forward, the hand is fixed in a state of exten-
sion proportioned to the degree of the displacement; the fin-
gers are more or less bent; the carpus projects at the ante-
rior part of the articulation; a depression, or transverse fold
is perceived below the inferior extremity of the radius; and
the flexor muscles are tense. 2d. In the luxation backward,
the hand is fixed in a state of flexion; the fingers are ex-
tended, or may be extended, without effort; the carpus forms
a projection at the posterior part of the joint; there is a
depression, or transverse fold, below the inferior extremity
of the forearm, on the palmar side; and the extensor muscles
are tense. 3d. In the luxation outward, the hand is strongly
inclined toward the ulnar edge of the forearm, and is fixed in
this situation; and the external side of the carpus projects be-
low the inferior extremity of the radius. 4th. In the luxation
inward, the hand is strongly inclined toward the radial edge
of the forearm, and the internal side of the carpus forms a
projection below the inferior extremity of the ulna.

In general, luxations of the wrist are very serious acci-
dents, on account of the extensive laceration of the liga-
ments, &c. in consequence of which there is extreme pain,
inflammation, and collections of glairy or synovial matter
in the sheaths of the tendons, and sometimes even abscesses.
The cure is tedious; and the motions of the wrist are al-
ways more or less impaired, and sometimes lost. In many

instances, gangrene takes place, or an excessive suppuration, which renders amputation necessary to save the life of the patient, or terminates in caries of the articular surfaces. M. Thomassin relates a case, which is a happy exception to the general termination of these accidents. A child, aged six years, in a fall from a horse, luxated the wrist of the left hand. The extremity of the radius penetrated the integuments at the internal side of the wrist, between the radial artery and the bundle of flexor tendons, and projected out the distance of a finger's breadth; the ulna remained beneath the muscles, and extended beyond the os unciforme; notwithstanding which the cure was perfect. There remained only a slight swelling of the bone, which did not embarrass the movements of the joint.

Incomplete luxations of the wrist are easily reduced; but complete luxations, especially if attended with great inflammation and swelling, are reduced with the utmost difficulty. Unsuccessful attempts at reduction add greatly to the severity of the accident, by increasing the irritation. We should, therefore, employ the most powerful antiphlogistic remedies, and, after the inflammation is dissipated, if it be not then too late, proceed to the reduction in the following manner: The patient being seated, a strong assistant embraces the upper part of the forearm with his two hands; another assistant, still stronger and more intelligent, takes hold of the metacarpus, as near as possible to the wrist; the two assistants draw the limb in contrary directions, with a gradually increased power, until the extension is sufficient; the surgeon, at this moment, pushes the bone in a direction opposite to that in which it was displaced; at the same time directing the assistant, who has hold of the hand, to press the bone towards its natural cavity.

After the reduction is effected, the joint is to be covered with oblong compresses, wet with a resolvent liquid, and a roller applied over the whole. This simple apparatus is sufficient in lateral luxations, but in luxations forward or backward, it is necessary to apply two splints, as in fractures of the forearm.

In this luxation, above all others, we should guard against inflammation. If the patient experience but a moderate degree of pain, the apparatus should not be removed until the expiration of two or three days. This treatment is to be continued until we think proper to move the hand in order to prevent its becoming stiff.

However well the reduction may have been effected, a degree of swelling often remains, which greatly impedes the

movements of the wrist and fingers. Patients and unin-
structed surgeons are often led to think that the bones have
not been reduced until they are convinced to the contrary by
the gradual disappearance of the swelling.

If abscesses form about or in the joint of the wrist, they
should be opened as soon as there is evident fluctuation ; but
we should be careful not to be deceived by false perceptions,
and open the joint where there is no collection of pus. The
formation of matter, however, is generally followed by an-
chylosis of the wrist, and sometimes leads to the necessity
of amputating the forearm.

In cases where the radius projects externally, we should
not hesitate to enlarge the opening of the skin, if necessary,
in order to facilitate the reduction.

ARTICLE II.

Of Luxations of the Bones of the Carpus upon each other.

The os magnum may escape from the cavity formed by the
scaphoides and semilunare, into which it is received. When
the hand is flexed, the head of the os magnum is inclined
backward ; it raises the capsular ligament ; and, if this move-
ment be carried very far, the capsule and the accessory liga-
ment are torn, and the head of the os magnum is luxated.
This accident is not very common, and occurs more fre-
quently in women than in men, and is caused by a fall upon
the back of the hand, or by grasping a body with the hand,
and bending the wrist strongly.

The signs of this accident are, a hard, circumscribed tu-
mour in the situation of the head of this bone, increased by
flexion, and diminished by extension of the hand. In this
position, a slight compression will cause it entirely to disap-
pear. Scarcely any inconvenience results from this luxation.
The tumour which it occasions is hardly perceptible in a
woman whose hand is thick. The bone is easily pressed into
its place while the hand is extended, but it requires some
pains to keep it there—more than most patients are wil-
ling to submit to for so trifling an accident.

ARTICLE III.

Of Luxations of the Bones of the Metacarpus.

The articulations of the bones of the metacarpus with those of the carpus, are never the seat of luxations.

The metacarpal bone of the thumb may be luxated backward, but in no other direction.

The most frequent cause of this luxation is a fall upon the external edge of the hand, which, by forcibly flexing the thumb, lacerates the capsule, and throws the upper end of the bone out of its cavity, behind the trapezium.

When this luxation exists, there is a hard tumour formed by the upper extremity of the luxated bone; the thumb and the first metacarpal bone are bent; the patient cannot extend the finger, and, in attempts to do so, suffers acute pain. A great degree of swelling sometimes renders it difficult to ascertain the existence of this accident, and, if we merely apply poultices, it becomes irreducible; or if we even effect the reduction, as the capsular ligament will have formed adhesions in the situation in which it was thrown by the accident, the luxation easily recurs, and the movements of the thumb are ever afterwards embarrassed.

To reduce this luxation, we are to direct one assistant to take hold of the thumb, and another to grasp the wrist; while they are drawing in opposite directions, we are to push the head of the bone, forwards and downwards, into its cavity. A dull noise is heard at the moment of the reduction, and the deformity disappears. A compress, wet with a resolvent lotion, and a small splint should be applied to the thumb, to prevent a recurrence of the luxation. If, however, there be much inflammation, the parts should be covered with poultices two or three days before we apply the compresses, &c. After the luxation has remained for some time unreduced, the bone may still be replaced, but the luxation immediately recurs. Madame de la P— fell upon the external edge of the left hand, and luxated the first bone of the metacarpus backward. A surgeon, who saw it, mistook the nature of the accident, and applied emollient poultices and resolvents. There remained a deformity at the external side of the carpus, and the movements of the thumb were impaired, especially that of extension. Two months after the accident, the luxation was easily reduced by another surgeon, who advised the application of a splint and roller to prevent a recurrence of the ac-

cident; but these means were neglected. I saw the lady four
months afterwards: The projecting end of the bone could
easily be pushed into its place, and, while kept there by pres-
sure the movements of the thumb were as free as ever; but
the moment the pressure was removed the luxation returned.

ARTICLE IV.

Of Luxations of the Fingers.

The first phalanx of the fingers and of the thumb, may be
luxated backward, forward, and to either side. That of
the thumb is more frequently luxated than all the rest.

This bone is most generally displaced backward. Many
persons have the power of producing this luxation at plea-
sure. We do not know if this circumstance arise from a
particular structure of the joint, or from a relaxation of its
ligaments.

Independently of any particular disposition of this kind,
the thumb may be luxated backward when it is violently ex-
tended by an external cause: The bone of the first phalanx
passes up behind the head of the first metacarpal bone, tear-
ing the capsular ligament and tendons of the extensor mus-
cles; the lateral ligaments are not broken.

It is scarcely possible to mistake this accident. The first
phalanx is extended, so as to form almost a right angle with
the metacarpal bone. Its head projects at the anterior part
of the articulation. The last phalanx is bent, and, like the
other, immoveable.

This luxation, easily reducible at first, soon becomes irre-
ducible if left to itself. I have attempted the reduction ten
days after the accident without success. Desault, foiled in
a similar case, proposed to make an incision behind the head
of the luxated bone, and to introduce a lever to pry it into
its place. But the patient would not submit to the operation.
The difficulty of effecting a reduction in these cases arises,
no doubt, from the small hold which the thumb offers for ex-
tension, and the resistance of the strong muscles which sur-
round the joint.*

The method of reducing this luxation is as follows: One
assistant places his hands firmly around the patient's wrist;
another strong assistant extends the thumb; as soon as the

* See note H.

surgeon perceives that the bone has yielded to the extension, he pushes its head downward and forward, directing the second assistant, at the same moment, to flex the thumb. It is sometimes necessary to make the extension by means of a bandage.

When the luxation is reduced, oblong compresses, wet with a resolvent liquid, are to be applied, their ends crossing on the back of the thumb. Over these we should pass a roller, and place the hand in a sling. While there is much swelling, we may substitute poultices for the resolvent liquids.

Luxations of the first and second phalanges of the fingers backward, and those to one side, are very rare, very easily discoverable, and requiring no particular directions for their treatment.

CHAPTER XXXIV.

Of Luxations of the Thigh.

THE strength of the articulation of the femur with the pelvis is such, that the thigh can only be luxated by very great external violence, and circumstances which rarely occur. In falls, the neck of the femur is broken more frequently than it is luxated. The thigh may be luxated in four different directions, viz. upward and outward, downward and inward, upward and forward, and downward and backward. The two first are the most frequent. The luxation upward and forward is very rare, and that downward and backward the least frequent of all: it can only take place secondarily.

At whatever part of the acetabulum the head of the femur escapes, the capsular ligament is always torn. In luxations downward and inward, the round ligament may yield, and escape being broken; but it is always lacerated in the other kinds of luxations.

In luxations upward and outward, the head of the femur passes, more or less, backward upon the dorsum of the ilium, between the fossa iliaca externa and the glutæus minimus, which it raises up, and by which, if I may use the expression, it is capped. The capsular ligament, torn at its lower and external part, is stretched over the acetabulum; the glutæi, psoas, and iliac muscles, the pyramidalis,

the gemini, the obturatores, and the quadratus are length-
ened from the same cause.

This luxation is always caused by a fall from a height, in
which the thigh is carried forcibly forward and inward.   In
this movement the luxation is favoured by the contraction
of the glutæi muscles. The signs of this luxation are as
follow ; the thigh is shortened ; the fold of the groin is
higher than that of the opposite side ; the thigh is thrown in
a state of flexion and adduction ; it is turned inward, as well
as the knee and the point of the foot ; the great trochanter is
nearer the crest of the ilium than in the natural state ; the
head of the bone forms a tumour on the dorsum of the ilium,
and the patient can neither extend the thigh, adduct it, nor
rotate it outward; the movements of flexing, adducting,
and rotating the thigh inward, may be made to a slight de-
gree without increasing the pain ; if the patient walks while
the reduction is yet unreduced, he touches the point of the
limb to the ground, but still finds the limb shorter than the
other, and, of course, limps. All these phenomena are
easily explained, except, perhaps, the rotation inward, which
takes place, notwithstanding the gemini, the obturatores,
and the quadratus are put upon the stretch; this arises,
probably, from the resistance of a portion of the capsular li
gament that proceeds from the anterior and inferior spine of
the ilium, and resists the actions of the muscles which turn
the thigh outward.

In luxation downward and inward, the head of the femur
is lodged between the ligament which closes the foramen
ovale and the obturator externus muscle.   The internal
and inferior part of the capsular ligament is torn, but the
round ligament is not ruptured ; the glutæi, pyramidalis, ge-
mini, obturatores, and quadratus are in a state of tension ;
the adductors, elongated, form, at the inner side of the limb,
a tense cord, that extends from the pubis below the middle
of the thigh.

This luxation is always caused by external violence, which
carries the thigh outward.   In the abduction of this limb,
the head of the femur slips to the inner and lower part of
the acetabulum ; a part of it is raised above the head of the
cavity, and is only supported by the capsular ligament.
Now, if this movement be suddenly carried very far, (as for
instance, in a fall from an elevation, when the thigh, sepa-
rated from the body, receives its whole weight) the capsular
ligament is torn, and the head of the femur abandons the
acetabulum.   This luxation is favoured by the external and

superior edge of the acetabulum, furnishing a fulcrum to
the superior and outer part of the neck of the femur, by
which the neck is pryed over the opposite side. The mus-
cles have no agency in producing this accident; which is
rare, because, in falls, the thighs are seldom separated.

The signs of this luxation are as follow: The affected
thigh is longer than the sound one: we perceive, below the
groin, at the internal part of the thigh, a tumour, formed
by the head of the femur, placed in the foramen ovale; the
buttock is flattened; the trochanter is no longer felt in its
natural place; the fold of the groin is situated lower than
that of the opposite side, and, instead of describing a cres-
cent, as in the natural state, it forms an obtuse angle, as if
the middle of it were pinched up; the leg is slightly bent;
the thigh separated from that of the opposite side; a hard
chord is felt in the situation of the abductor muscles; the
foot and knee are turned outward by the glutæi muscles; the
thigh cannot be turned inward, and any attempt to perform
this movement causes acute pain, on account of the tension
which it gives to the glutæi muscles. If we put the patient
on his legs, the luxated limb being longer than that of the
opposite side, the foot is raised by flexing the knee; and,
if the patient wishes to straighten the limb, he carries it
forward, and to one side, making the foot describe an arch of
a circle.

Luxation upward and inward is much more rare than that
of which we have spoken. We have, however, met with
three instances of it, and there is a great number on record.
The head of the femur is thrown upon the horizontal branch
of the pubis, under the psoas and iliac muscles; the upper
part of the capsular ligament and the round ligament are
torn; the glutæi, pyramidalis, gemini, quadratus, and ob-
turator muscles are elongated—all the other muscles are re-
laxed; the femoral vessels, and crural nerve, are pushed in-
ward, perhaps a little raised by the head of the femur: but
the compression of these parts does not occasion gangrene of
the limb in cases where the luxation is not reduced.

The cause of this luxation is a great force which carries
the femur backward, while the pelvis is pushed forward. It
has never happened under any other circumstances. The
thigh is shorter, and slightly extended; the knee and point
of the foot are turned much more outward than in the lux-
ation downward and inward; the great trochanter is raised
and brought forward, almost in the same vertical line with
the anterior superior spinous process of the ilium; the head
of the femur is felt in the groin, and, within it, the pulsa-

tions of the femoral artery are plainly distinguishable. The patient complains of pain in the groin, the buttock is flattened, and the curved line, which separates it from the thigh, is higher than in the natural state. We cannot turn the thigh inward, and if we attempt to do it, the patient experiences great pain.

According to J. L. Petit, the whole limb becomes numb and swollen if the luxation is not immediately reduced. We have never seen this phenomenon, nor the tumefaction of the scrotum, which most authors, following Hippocrates, say, is more frequent in this luxation than in others. The luxations we have met with were immediately reduced.

We do not think the femur can ever be luxated downward and backward; but it may be carried in that direction after a luxation upward and outward; that is to say, the head of the femur, thrown, in the first instance, upon the external iliac fossa, may, if the thigh be afterwards adducted by any cause whatever, slip down before the upper part of the ischiatic notch; but it can never reach the junction of the ilium and ischium. This secondary luxation of the femur may, therefore, be considered as a variety of the luxation upward and outward.

The luxation downward and backward would be characterized by a strong flexion of the thigh, a turning of it inward, the impossibility of extending it or turning it out, and the removal of the trochanter major backward and downward, from the crest of the ilium.

It would seem easy to distinguish between luxation of the thigh and fractures of its neck, or separation of its head in young patients: yet Verduc, Ambrose Paré, and J. L. Petit acknowledge that they confounded them with each other. We cannot, therefore, pay too much attention to the diagnostic symptoms.

In fracture of the neck of the femur, the limb is shortened, and the point of the foot and knee are turned outward, but the limb is easily restored to its natural length and direction by slight extension of the foot. The luxation upward and forward, which most resembles fractures of the neck of the femur, is accompanied by a shortening of the limb, and turning of the foot and knee outward; we cannot give the limb its natural length and direction without reducing the luxation, which requires considerable force, and, moreover, the head of the femur is plainly distinguishable in the groin. In luxation upward and outward, the limb is shortened, as in fractures of the neck of the femur, but the foot is turned in. As to the luxation downward and inward

though the toe is turned out, as in fracture, the limb is lengthened.

Considering the injury that must necessarily be done to the soft parts, in luxation of the femur, we should be inclined to think that very serious consequences would result from it. But we know, from experience, that the pain and inflammation are soon dissipated after the bone is replaced; and patients have been known to walk eight or ten days after the accident. Even when the luxation is not reduced the pain and inflammation do not continue very long, and the limb soon acquires the power of performing those motions which the luxation does not prevent.

The reduction of a dislocation of the femur is among the most difficult, especially in robust patients. The luxations downward and inward, and upward and inward, are more easily reduced than those upward and outward.

After what period are luxations of the femur irreducible ? We cannot answer this question with precision. J. L. Petit speaks of a child whose femur was luxated, in parturition, by the awkwardness of a midwife in drawing upon the feet. As the accident was not discovered until five years afterward, he thought this time quite too long to think of a reduction, but adds, that luxations of one or two months standing are easily reduced : Yet he cites no case in proof of this assertion. In the Memoirs of the Academy of Surgery a case is related of a luxation of the thigh upward and outward, which, after having been mistaken for two years, was then reduced. But this case was accompanied by particular circumstances, and we cannot draw any inference from an insulated fact of this kind.

Nature, ever attentive to the remedying of the disorders of the animal economy, restores the power of walking even when the femur is not reduced. In luxations upward and outward, the thigh remains short, and becomes shorter daily, until the head of the femur has made for itself a sort of articular cavity in the external iliac fossa ; the acetabulum becomes nearly, or quite obliterated ; the glutæus minimus is emaciated, and serves as an orbicular ligament to the new articulation ; the head of the femur loses its spherical figure, is forced backward, and its neck becomes shorter ; the person is lame, and walks on the point of the foot. If the luxation is downward and inward, the foramen ovale becomes the new articulating cavity ; the obturator externus, raised and pushed inward by the head of the femur, becomes emaciated and ligamentous, and, sometimes, it and the

glutæus minimus even ossify. The lameness, in this case, arises from the too great length of the diseased limb, which always diminishes in size, in consequence of the muscles not being sufficiently exercised, or their actions being impeded.

With some differences, which will hereafter be pointed out, the method of reducing all luxations of the thigh is the same. The patient is laid upon a firm table, covered with a mattress, or upon a bedstead without a head-board or foot-board; or, if neither of these can be had, upon a trunnel bedstead, with several mattresses upon it. The patient being thus placed, we may, sometimes, reduce the luxation by making a strong assistant take hold of the ankles, and draw the limb downward, while another assistant steadies the pelvis; but, most commonly, we are obliged to make use of a greater number of assistants: that they may act conveniently, a sheet should be laid in folds of five or six inches breadth, and the middle of it laid above the ankles, previously protecting them with cotton-wool, or compresses of linen; the ends are now to be brought together, twisted, and given to the assistants.

To make the counter-extension, the middle of another sheet, folded like the former, is to be laid upon the internal part of the sound thigh, in like manner protected by some soft substance intervening; one of the ends of this bandage is to be passed over the fold of the groin, and the other behind upon the buttock of the same side, and, being brought together above the crest of the ilium, they are to be twisted and given to the assistants. This bandage alone is not sufficient to fix the pelvis: another should be so disposed as to embrace the pelvis of the same side, in the space between the crest of the ilium and the trochanter major; the extremities are to be carried a little obliquely upward, across to the other side. By acting, at the same time, upon these two last bandages, the pelvis is fixed, and none of the muscles around the articulation are compressed and made to contract, so as to increase the difficulty of the reduction.

The surgeon, standing on the external side of the limb, gives the signal to the assistants. Those who are to make the extension draw the bandages in the direction in which they have received them; those who are to make the counter-extension act differently, according to the kind of luxation to be reduced: In that upward and outward, the extension must be made obliquely inward, and a little forward; in the luxation downward and inward, the extension should be

made obliquely outward; in that upward and inward, the extension should be made in a direction nearly parallel to the axis of the body :—in a word, the extension should always be made in that direction in which the limb is thrown by the accident.

If the head of the femur has been thrown outward and upward, the surgeon, placing his two hands upon the trochanter major, presses it downward and inward ;—if downward and inward, the surgeon places his hands around the internal and upper part of the thigh, and draws it upward and outward, while the assistants, without discontinuing the extension, direct it inward :—if upward and inward, he presses the head of the femur downward and outward : As to the luxation downward and backward, as it is in almost every instance secondary, we should first endeavour to carry the head of the bone to the place it occupies in luxation upward and outward, and afterward act accordingly :—in a word, we should make the head of the bone return by the same route it took in leaving its cavity.

At the moment that the luxation is reduced, we hear a noise, produced by the striking of the head of the femur against the acetabulum ; the length and rectitude of the limb are restored ; it can be moved, and the pain ceases. Sometimes, after the reduction, the limb is a little longer than the other, which arises from the head of the femur not entering deeply into the acetabulum. This phenomenon generally disappears in a few days.

The method just recommended generally succeeds ; if it fails, machinery will seldom answer any good purpose. The surgeon should endeavour to discover the cause of the failure : Perhaps the extension and counter-extension have not been strong enough—if so, increase their force. Perhaps the muscles have contracted spasmodically—if so, let the patient be bled, placed into a bath, and put upon a very low diet, and let the local irritation be assuaged by emollient and anodyne applications.

To keep the femur in place, the knees should be brought together; the patient should be carried to his bed, and a bandage passed round the lower part of the thigh, in the form of the figure 8. Compresses, or a poultice of an emollient or anodyne tendency, should be applied to the joint. The patient should not be allowed to walk until the pain is entirely dissipated, which generally requires a period of twenty or thirty days. Without these precautions, and that of walking with a stick, the recurrence of the spontaneous

luxation of the femur is endangered. We shall add, in con-
clusion, that, if we are ever so unfortunate as not to be able
to reduce a luxation of the femur, that the patient should be
confined to his bed for a very long time, and when he begins
to walk, he should use crutches.

CHAPTER XXXV.

Of Spontaneous or Consecutive Luxations of the Femur.

THE terms spontaneous luxation of the femur, consecu-
tive luxation, morbus coxarius, &c. have been applied
to a disease of the hip joint, in which the head of the femur,
gradually pushed out of the acetabulum, ascends on the ex-
ternal side of the os innominatum, or descends into the fora-
men ovale. This disease was known to Hippocrates, who
speaks of it in the fifty-ninth or sixtieth Aphorism of the sixth
section; but he is far from offering the exact description
which has since been given, by J. L. Petit, in the Memoirs
of the Academy of Sciences, for the year 1722; and by Mr.
Sabatier, in the Memoirs of the Royal Academy of Surgery.

This disease may be produced by an external cause, or an
internal cause, or by both conjointly.

A violent contusion of the hip joint, produced by a fall on
the trochanter major, the knee, or the feet, is not an unfre-
quent cause of this disease; but, most frequently, it is only
an occasional cause; and, still more often, the disease is
the consequence of scrofula, rheumatism, gout, small-pox,
measles, typhus fever, &c. It is more common in infancy
than in adult age.

J. L. Petit thus explains the mechanism of this luxation:

" In falls on the trochanter, the head of the femur is vio-
lently pushed against the acetabulum, and, as it exactly fills
this cavity, the cartilages, synovial glands, and the round li-
gament are bruised: hence follow inflammation and suppu-
ration. The synovia collects in the cavity of the joint, the
capsular ligament becomes distended by it, and the head of
the bone is gradually pushed out of its socket. This fluid,
continuing to collect in the cavity, and not being dissipated
by the movements of the part, relaxes the ligaments, which
are further distended by the action of the muscles. Not

only the capsule, but the round ligament is gradually elongated, and the pain continues to augment until this ligament, entirely relaxed or broken, leaves the bone free to take that course in which the action of the muscles shall direct it."

This explanation appears, at first sight, to be plausible; but it is specious. If there were any increased quantity of synovia, it would collect between the neck of the femur and the capsular ligament, and distend the latter; but it can never stretch this ligament, nor the muscles around the joint, and remove the bone from the cavity; for, if the synovia were to become thick, it would rather retain the bone in the acetabulum than displace it. It is certain, then, that Petit was mistaken, and we can give little weight to his conjecture, which was not derived from any anatomical examination.

In fact, I know of no examination whatever in the early state of the disease; but, probably, the synovial gland and the cartilage which covers the acetabulum and head of the femur are swollen, and this swelling, by destroying the proportions which ought to exist between the depth of the acetabulum and the size of the head of the femur, gives rise to the elongation of the limb, which, in almost every instance, takes place from the commencement of the disease.

The examination of persons who have died of consecutive luxations of this kind, has shown that the synovial gland, which, in the sound state, fills a small depression of the articular cavity, is so swollen as to occupy every part of it. The cartilage which lines this cavity and the head of the femur, has been found thickened and softened; sometimes the round ligament is destroyed; at other times the cavity of the joint is filled with steatomatous concretions, and fetid flocculent pus, of various colours. The cartilage is eroded in some parts; but the most frequent lesion that is discovered is caries of the edge of the cavity, and the absorption of bone which attends it. Not only are the different parts of the acetabulum and the head of the femur found in a morbid state, but also the dorsum of the ilium, on which the head of the femur rests after being luxated, in consequence of the disease, is softened, so that considerable portions of bone may be detached. The pus runs between the muscles, and collects in considerable quantities under the skin, and forms fistulæ, which communicate with the cavity of the joint. In one particular kind of this disease, the caries is confined to the bottom of the cotyloid cavity, which becomes filled with ill-conditioned pus. This is discharged into the pelvis, and the patient dies, without any displacement of the femur.

From what has been said, it will be easily seen how a luxation of the femur may be caused by a swelling of the parts within the articulation. The head of the bone being raised to the edge of the cotyloid cavity, and then drawn up by the action of the glutæi muscles.

But when the luxation arises from a distension of the upper part of the acetabulum, the head of the bone is drawn up by the muscles, without being previously separated from the bottom of the joint. I say drawn *up*, because the superior and outer part of the acetabulum is most often carious; but, in some rare cases, the internal and lower part is destroyed, and the head of the bone is thrown upon the foramen ovale.

It is of great importance to discover this disease as early as possible. We shall, therefore, describe its symptoms very particularly: They are different according to the periods of the disease, and the cause which has produced it. The first period comprehends the time from the commencement of the complaint to the escape of the bone from the acetabulum: it is characterized by pain, increase in the length of the limb, and lameness. These symptoms come on at the same time, but the pain is that of which the patient complains the most. It is felt in the hip, and, generally, also in the corresponding knee: sometimes much more in the latter place than in the former. Thus practitioners are often mistaken as to the real seat of the disease. But we shall not be deceived if we press upon the knee: for this excites no pain, while the hip is exquisitely sensible to the touch. The pain is very acute when the disease has been caused by a severe contusion, and is then often accompanied with a swelling of the superior part of the thigh, fever, and inability to move the limb. But when the disease depends upon an internal cause, the pain is generally moderate, dull, and deep-seated. In all cases it is increased by walking. We have seen patients who, in the commencement of this affection, complained of pain in every part of the limb, and in whom the leg was bent and the foot extended, so that they walked upon the joint of the latter.

The lengthening of the limb commences at the same time that the pain is felt: at first it is so inconsiderable as to escape the attention of practitioners who do not compare the limb exactly with the other; it increases as the disease progresses, and is greatest at the time when the head of the femur is on the point of leaving the acetabulum. In luxations caused by the swelling of the synovial glands, and the cartilages of the joint, the lengthening of the limb is much

greater than in those which take place in consequence of ca-
ries of the border of the acetabulum. In the latter case, it
is so small that some practitioners have denied its existence
altogether. But we never saw a case in which it could not
be observed, and we are convinced that it does always take
place.

To ascertain if the limb be lengthened, the patient should
be laid upon his back; the anterior superior spinous pro-
cesses of the ilium should be placed in the same transverse
line. If the limb be lengthened, we then see the internal
ankle and the patella lower than those of the opposite limb.
If, at the same time, we find the trochanter major further
from the crest of the ilium than natural, we may be sure
that the lengthening of the limb depends upon the removal
of the head of the femur from the bottom of the acetabulum.
Without this latter phenomenon, we cannot be certain that
the lengthening of the limb does not depend upon a disease of
the ilio-sacral articulation.

Limping always attends the commencement of this dis-
ease. It arises from the lengthening of the limb, and the
pain in the joint. When the patient attempts to bear the
weight of his body upon the affected limb, the pain he feels
obliges him soon to support himself upon the other. The
lameness is greatest when the limb is most lengthened.

Such are the symptoms of the first stage of this affection.
The duration of these varies according to the age of the pa-
tient, the violence of the disease, and the nature of the or-
ganic affection of the parts. In children, it is shortest, on
account of the lesser depth of the acetabulum, and the greater
rapidity with which the synovial gland enlarges; moreover,
caries in them make a more rapid progress than in adults.
We have seen children in whom the femur was luxated in
two months; in adults the duration of the disease is shortest
when the pain and irritation are most severe. We have known
two patients in whom the pain was excessive, and who
passed through the first stage of this disease in the course of
an idiopathic fever. Both cases terminated in anchylosis.

The second period of this malady commences with the
luxation of the femur, and terminates with the termination
of the disease. The escape of the head of the femur from the
acetabulum enables the surgeon always to pronounce with
certainty as to the nature of the complaint. My experience
leads me to believe, that when considerable shortening takes
place at once—when the pain is great, and there is no swel-
ling of the upper part of the thigh, the luxation is produced
by a swelling of the synovial gland and the articular carti-

lages; and that, in other cases, the displacement of the bone arises from caries. When the affected limb is much longer than the other for a great length of time, and yet is not turned inwards and outwards, and, at the same time, the patient is capable of rotating it, (though with pain) and an abscess by congestion is formed upon any part of the thigh, we may be certain that there is extensive caries of the bottom of the acetabulum. Such cases sometimes terminate fatally without luxation of the femur.

When the head of the femur is removed from the cavity of the acetabulum, in consequence of a swelling of the synovial gland, it passes upward and outward, and the thigh becomes shorter than its fellow, and nearer to the axis of the body; the knee and the point of the foot are turned inward; the trochanter major becomes more projecting, and is approximated to the crest of the ilium: in fine, there is every symptom of primitive luxation upwards and outwards.

In some rare cases, the disease here stops; the pains are gradually dissipated; the head of the femur forms a new cavity, and the patient is able to walk with limping: but far more frequently, after the head of the femur is displaced, the buttock swells and becomes painful; the cellular tissue becomes thickened, and the skin tense and shining, so that the part has the appearance of a lymphatic tumour: some points at length soften and open, or are opened by art. In either case, the opening remains fistulous. It sometimes happens, that the flow of pus, after having been very great, diminishes; that the pains abate, and all the symptoms gradually subside, and, after several years, the disease happily terminates in an union of the so femoris with the os innominatum: but, most frequently, the fistulæ continue to furnish a great quantity of pus; at first thick and inodorous, afterwards thin, acrid, and fetid. This being absorbed and carried into the circulation, gives rise to hectic fever; the patient falls into a consumption, and dies.

When this disease depends upon caries of the edge of the acetabulum, abscesses form quickly; sometimes even before the luxation takes place matter collects in the upper part of the thigh, with all the appearances of an abscess by congestion, and not preceded by any inflammation of the part in which they appear, the pus having run along the interstices of the muscles from the articulation which is its source. In some cases, other abscesses, also, form at the groin, in consequence of an inflammation of this part. The openings of these abscesses remain fistulous.

In its early stage this disease may often be cured; but

when luxation has taken place, the patient is inevitably rendered lame for life. Scrofula and debility increase the danger of this disease. When the luxation is produced by an external cause, it is less dangerous than when it arises from an internal cause. The luxation which is caused by a swelling of the synovial gland, is not so often fatal as that which is occasioned by caries. Cases in which the head of the bone is thrown into the foramen ovale, being generally connected with extensive caries, are almost always fatal; and a fortiori those in which there is caries at the bottom of the acetabulum, are the most fatal of all.

If called before the luxation has taken place, we should endeavour to prevent it. If the patient have suffered a contusion of part, we should direct the most perfect rest and severe regimen: he should be bled several times during the first twenty-four hours, if his strength permit; we should apply fifteen or twenty leeches around the joint, renewing them the first or second day after; we should apply emollient and anodyne applications to the part. A decided treatment seldom fails of success; but, unfortunately, few persons will submit to severe remedies, and still less to keeping the bed for several months for a disease which, to them, appears trifling. Most persons get up and walk as soon as the pain has become moderate; thus rendering the disease incurable.

This luxation may be owing to an internal cause, which, either spontaneously, or in consequence of a fall, blow, a false step, or an immediate separation of the thighs, has settled in the hip joint. In these circumstances, the indication is to effect a revulsion of the morbid principle, and to remove the internal disease. For the first of these objects, the actual cautery, moxa, caustics, cupping instruments, setons, and blisters, have been alternately recommended. We prefer the last. Our patients are kept in bed, and not suffered to make the slightest movement of the affected limb; we direct a large blister to be laid upon the upper and outer part of the thigh. This is kept on twenty-four hours, and dressed with cerate. In five or six days another blister is applied by the side of the other; then a third, &c. The blistering should be continued until the pain is entirely removed, and the limb restored to its natural length. It sometimes happens, that, after having done good for a time, the blisters produce a contrary effect—augment the pain, and cause a spasm of the muscles of the thigh. When this occurs, we should discontinue the use of them, and apply emollients, leeches, and baths.

As to the number of blisters, two or three are sometimes sufficient: in other instances, twelve, or more, are required. After they have removed every symptom of the disease, the patient must continue to keep his bed. From neglect of these precautions, we have known severe relapses. To prevent a return of the complaint, we often insert a seton, or form an issue in the arm. Toward the close of the disease, sulphurous waters are useful; but we have seen them do much injury in the early stages.

The internal treatment is various, according to circumstances.

If, notwithstanding every effort to arrest the disease, it continues to progress, and the head of the femur is thrown into the foramen ovale, an abscess by congestion forms at the internal, or at the posterior part of the thigh, and the patient dies. The abscesses ought never to be opened, unless the tension and pain in the parts render it unavoidable.

When the head of the femur passes to the dorsum of the ilium, the case is not so hopeless. We should make the patient extend the thigh as much as possible, and, when he begins to walk, we should advise him to bear upon the joint with great circumspection. After the irritation has subsided, we may use pumpings and baths of sulphurous waters; but, unfortunately, it most often happens that abscesses form, and the patient at length dies of hectic fever.

After the luxation has taken place, the patient sometimes gets off with an anchylosis: the pus becoming less abundant, thick, and inodorous; the appetite returning, &c. Under such circumstances, we should give bark and its different preparations. De Haen recommended large doses of of this substance, with a milk diet. The fistulous openings should be covered with Nuremburg or diacholon plaster; the sores should be kept very clean, and, if the skin inflame, we should apply an emollient poultice; the discharge of pus should be promoted by detergent injections made with a decoction of the leaves of black-walnut, St. John's wort, liverwort, &c. or by an alkaline solution, of a strength proportioned to the sensibility of the parts; the limb should be kept as much as possible at rest, and in a vertical direction. The anchylosis requires several years for its completion in adults; something less in children.

CASE I. The son of Count D. aged fourteen years, of a lymphatic temperament, strong and large for his age, without any known cause, felt a dull pain in the upper part of the left thigh, and in the knee of the same side, which made him limp a little. Having laid him on his back, and adjusted

the anterior superior spinous processes of the bones of the ilium, in the same transverse line, I discovered that the left thigh was four or five lines longer than the right. These symptoms left no doubt as to the nature of the affection. I advised that he should keep perfectly quiet in bed, and applied successively several blisters around the affected joint, and prescribed bitters and anti-scorbutics. In a few weeks the lengthening of the limb was removed, and the pain dissipated, but I would not suffer the patient to get up and walk about until the expiration of two months. At this time walking caused no pain, and I hoped my patient was entirely well, when he imprudently made forced motion of abduction in straddling a billet of wood. This brought back his former symptoms. He was kept at rest six weeks more, and, to guard against the return of the disease, I applied a blister to his arm, and advised his parents to keep it open for a long time, and to continue the use of bitters and anti-scorbutics. The patient has had no return of his complaint.

CASE II. Mademoiselle P—, aged seventeen, of a lymphatic, sanguine temperament, and of a delicate constitution, felt some pain in the hip joint, at the age of nine or ten years, which was regarded as arising from weakness of the muscular system. At the age of sixteen she fell upon the left hip, and increased the pain by dancing. In the winter of 1804, being then seventeen years of age, the violence of the pains, rendered excessive by long continued dancing, obliged this young lady to make known her situation to her parents. The surgeon who was called in found the left leg six lines longer than the other. He prescribed perfect rest in bed, and applied a blister near the hip joint, and very judiciously endeavoured to promote the menstrual discharge.

The blister increased the pain in the upper part of the thigh, and caused it to attack the knee. The parents were unwilling to apply a second without further advice. Being called in consultation with the family surgeon, we applied three blisters in succession, with little diminution of the pain. After seven blisters were applied, the limb was restored to its natural length; but some slight pain remaining, two more were successively ordered. The patient, who had now been confined to her bed three months, was heartily tired of our treatment. She got up and sat in an easy chair, walked about the room with only a trifling lameness, which was afterwards dissipated by pumpings and baths of artificial sulphurous water of Barége. She was afterwards perfectly well, and is the mother of several healthy children.

CASE III. Monsieur De N—, aged thirty-seven years, of a

good constitution, and having always enjoyed perfect health, strained the thigh violently outward, in July, 1811. He was advised to keep the limb at rest, and apply brandy to the hip. As soon as the pain had diminished, he insisted upon getting up and walking about ; but he limped, and the pain was increased. This was his situation in the month of November following, at which time I was consulted. The right leg was four or five lines longer than the left. I advised rest and the application of anodynes, and, afterwards of resolvents ; but, instead of following my advice, the patient submitted to the pumpings of artificial Barège water. The first pumping increased the pain ; and, before the sixth pumping, the part became exquisitely sensible to the touch ; the muscles became convulsed, and the sufferings of the patient became so acute as to deprive him of sleep ; the length of the limb was increased. I now directed the application of leeches three successive times, embrocations with a liniment containing camphor and opium ; emollient and anodyne poultices ; cooling drinks ; the internal use of opium, and a low diet. Notwithstanding these remedies, the pain continued very acute for a month, and the patient could scarcely turn in bed. After this it gradually diminished, and, in three months and an half, the limb was restored to its natural length, and the pain had entirely left it. Monsier De N. then began to walk with crutches, which were afterwards discontinued as the limb became stronger, and, ten months after the accident which caused his disease, he was entirely restored.

CASE IV. The child of Monsieur F—, aged six years, apparently of a good constitution, having a brown skin, black hair and eyebrows, without any appearance of glandular swelling, complained of a still pain in the left hip, which caused him to limp. The family physician attributed the pain to his growth, and did not advise any remedy. Six months from the commencement of the disease, I was consulted : The limb was then six lines longer than the other. I advised that the child should be kept in bed, and that several blisters should be successively applied around the affected joint, and that bitters and anti-scorbutics should be administered. Four blisters were applied in as many weeks : the pain diminished, and the limb was restored to its natural length. The fifth blister was followed by so much pain that it became necessary to have recourse to anodyne and narcotic applications ; notwithstanding which, the lengthening of the limb returned. Seven or eight months of alternate augmentation and diminution of the pain ensued, but the length-

ening of the limb went on increasing. At length the head of
the femur left the acetabulum, and passed to the dorsum of
the ilium: the limb then became an inch and an eighth lon-
ger than the other; the knee and the point of the foot were
turned a little inward, and the pain almost entirely ceased;
no inflammation nor swelling of the buttock occurred, ex-
cept the projection of the head of the femur, which could be
plainly felt under the glutæi muscles. This led me to hope
for a cure by anchylosis. The child was kept in bed for two
months, with the thigh extended on the pelvis as much as
possible. At the expiration of this time, as the child com-
plained of no pain when he moved a little, I permitted him
to get up and walk with crutches. The limb gradually be-
came strong, and its movements more extended.

Case V. J. G—, a soldier, aged twenty-one years, under-
went great fatigue, in Spain, during the campaigns of 1807
and 1808, and felt, in those years, vague rheumatic pains:
sometimes in the loins; at other times in the thighs. When
he entered the Charité he complained of acute pain in the left
hip-joint, extending over the thigh to the knee, and causing
him to limp. Three blisters were successively applied around
the joint, without relief. In the fifteenth day, the patient
having turned in bed, the head of the femur abandoned the
acetabulum, and the limb was shortened two inches. One
month after his entrance into the hospital the patient had
hectic fever, the pain increased, and he died of marasmus.

Dissection. The glutæi muscles were thinned; the head of
the femur lay on the dorsum of the ilium, above and behind
the acetabulum: this cavity was somewhat enlarged, and
filled with a brown sanies; its sides were rough and perfo-
rated; the synovial gland was larger and denser than in its
natural state; the capsular ligament was completely de-
stroyed, except that part of it which contains the vessels that
supply the joint. The head of the femur and its cartilage
were diminished in size.

Case VI. James Francis D—, aged twenty-eight years, felt
pains in his hip, and limped for the space of two years pre-
vious to his entrance into the Charité. At this time he was
feverish; the hip was swollen, the thigh and leg were con-
stantly kept bent, and, in passing the fingers over the part,
a deep and equivocal sense of fluctuation was perceived. We
suspected that the internal side of the acetabulum was cari-
ous, because the knee was abducted. Several blisters had
been applied without relief.

On the 5th of September, a puncture was made into the
abscess, and a great quantity of inodorous and ill-conditioned

pus was discharged. On the 2d of January, another punc-
ture was made, with the like result. The patient grew
worse: he had diarrhœa, lost his appetite, and could not
sleep.

On the 10th of January, the hip-joint became extremely
painful and swollen, from the anterior part of the hip-
joint to the abdomen. On the 15th, a third puncture was
made, and a quantity of white and well-digested pus was
discharged. This, in some degree, relieved the patient. On
the 16th, an eschar separated from the sacrum, leaving the
bone exposed. On the 20th, a swelling of the knee, of which
the patient had complained for some days, opened and dis-
charged pus which had burrowed there. He died on the 23d
of February.

Dissection. The muscles of the buttock and groin were,
in a manner, dissected by the pus; the orbicular ligament
was destroyed, and scarcely retained any trace of its fibrous
structure; the head and neck of the femur were entirely
denuded; the cartilaginous covering was absorbed; the
acetabulum was much enlarged, especially at the internal
part of its circumference; the pus had destroyed the leva-
tor ani, and ran along the psoas to the loins; it passed out
of the pelvis with the latter muscle, and descended to the
knee.

CASE VII. A shoemaker, aged seventeen years, in walk-
ing in the woods, struck against the stump of a tree, and
fell upon his left knee. This was followed by acute pain in
the hip-joint of that side. It abated, however, and in four
days he was able to resume his work: but there was still a
dull, heavy pain in the joint, which rendered it irksome for
the man to stand or walk, and induced him to enter the hos-
pital Charité, several months after the accident: the left
thigh was longer than the right: the slightest movement
was painful, but neither the hip nor the knee were tender to
the touch. Two blisters were immediately applied, one upon
the trochanter, and the other upon the outer side of the
knee. Under this treatment, the patient's health was so
much improved, that, in two months, he left the hospital,
and went to work. All the symptoms quickly returned;
and a surgeon, who was consulted, mistaking the disease,
advised the man to stir about. He grew worse very rapidly,
and was brought to the Charité: poultices of flax-seed were
applied, and an abscess, situated upon the middle and ante-
rior part of the thigh, opened spontaneously; hectic fever
followed, and the man died, six months after his second en-
trance into the hospital.

Dissection. The abscess communicated with the joint by an opening below the arch of the pubis; the femur was as if worm-eaten, and extremely friable; there was an opening from the bottom of the acetabulum, leading to the pelvis.

CHAPTER XXXVI.

Of Luxations of the Patella.

THE tendon of the extensor muscles of the leg is inserted into the upper part of the patella; a strong ligament connects it with the tibia below; at each side it is retained only by the capsular ligament and the aponeurosis.

When the leg is flexed and extended, the patella slides up and down, and is pressed against the condyles of the femur, and, in this state, is immoveable: in the extended state of the limb, provided the extensor muscles of the leg are not in action, it may be pushed inward or outward.

The patella is always displaced when the tibia is luxated; but, in this chapter, we shall treat only of luxations of the patella unconnected with displacement of the tibia.

Strictly speaking, the patella is only capable of being luxated inward and outward. It may, indeed, descend; but this is always a consequence of rupture of the tendon of the extensor muscles of the leg. It may, also, ascend, if the ligament of the patella is broken. In the first case, if the leg is bent, the tibia will draw down the bone, as it draws down the inferior fragment in fracture of this bone; but, if the leg is extended, the patella remains in its natural situation: in the second case, the retraction of the extensor muscles of the leg will draw up the patella several fingers' breadth.

Lateral luxations are generally caused by external violence; but an excessive relaxation of the ligaments of the patella, and a particular conformation of the condyles of the femur, may permit this bone to be luxated by the contraction of the muscles.

According to most authors, the patella is more easily luxated inward than outward, from the internal condyle of the femur being less projecting than the other. This opinion is contradicted by experience. Luxation outward is most frequent; because the internal edge of the patella, more pro-

minent than the external, projects beyond the edge of the
femur, and is, consequently, more exposed to the action of
the causes of luxation.

In the first the patella entirely abandons the articular
pulley of the femur, and its posterior surface is placed on
the corresponding eminence of that bone. Complete luxa-
tions of the patella are extremely rare. In most cases, this
bone still remains upon the articular pulley of the femur,
but its ordinary relations are changed.

In the greatest possible flexion of the leg, the patella is
too deeply sunk between the condyles of the femur, and too
strongly pressed against the femur to yield to any external
force; but when the leg is slightly bent, and, particularly,
if it is extended, these cords are relaxed, the bone projects
and yields to external force, and is displaced inward or out-
ward, according to the direction given to it.

Luxation of the patella outward, is generally caused by
external violence acting upon the inner side of the bone,
while the leg is extended, or very little bent; the patella is
seldom thrown beyond the external edge of the femur, but
usually rests on it; the anterior surface of the patella is
turned inward, and the posterior surface outward; the inner
edge is turned backward, and the outer edge forward. The
patella cannot retain this position, but will slip down the in-
clined plane of the condyle, unless the ridge which divides
its posterior surface vertically have been pushed beyond the
external edge of the articular pulley.

The signs of this luxation are as follows: the leg is ex-
tended; any attempt to bend it increases the pain; we feel
the internal edge of the articular pulley, which the patella
has left; the patella forms a remarkable prominence on the
internal side of the joint, and the articular cavity may be
easily felt through the skin and capsular ligament.

Luxation of the patella inwards can only be occasioned by
a small body—for the force of a large body would be resisted
by the femur. This luxation, like that outward, is almost
always incomplete. It is characterized by a tumour before
the internal condyle; the anterior surface of the patella is
inclined outward, its posterior surface inward, its external
surface backward, and the internal forward; the external
condyle of the femur may be felt in the depression which the
patella has left; the leg is extended, and any attempt to
bend it causes acute pain in the knee. If the luxation were
complete, the visible cavity, in the natural situation of the
patella, would sufficiently show the nature of the case.

Luxations of the patella are not generally dangerous;

they may become so, however, if attended with severe con-
tusion of the knee.

We should proceed to the reduction of these luxations
without delay. The patient is to be laid upon his back, the
leg extended upon the thigh, and the thigh bent upon the
pelvis, and the whole limb supported by a solid plane, ca-
pable of resisting the pressure we may make upon the knee.
The surgeon then places the palm of his hand upon the pa-
tella, and forces it into its place.

This plan almost always succeeds in incomplete disloca-
tions on the first trial: but difficulties have been experienced
in the reduction of complete dislocations; and Valentin, in
his *Recherches critiques sur la Chirurgie Moderne*, informs
us, that a senior surgeon of one of the largest hospitals in
Europe had the temerity to open the capsular ligament, in
order to pass in an elevator to pry the patella into its place.
We need not dwell upon the dangers of such a procedure.

At the moment of the reduction, we hear a noise, made
by the patella striking against the surface of the joint; the
leg may be freely bent and extended, and the pain is greatly
diminished. After the reduction, the patient is to be confined
to bed, with the leg extended; the knee should be covered
with compresses wet with a resolvent liquid, and secured
by a roller. We should endeavour to prevent inflamma-
tion, by prescribing low diet and bleeding; and, if it comes
on, we should apply emollient and anodyne poultices. When
the pain is dissipated, we may begin to move the leg, and,
afterwards, cautiously permit the patient to walk with
crutches or a cane. There is seldom any tendency to a re-
petition of the dislocation: however, I have lately seen a
military gentleman who had luxated the patella outward, by
a fall, and in whom the bone had repeatedly got out of place
in walking. I advised him to wear a knee-cap, made of
chamois leather, which has prevented the recurrence of the
luxation.

Luxations of the patella are very rare: few cases are upon
record, and most of these are even imperfectly related. The
following is an abstract of a case related by Valentin. Count
D——, in riding on horse-back, struck his right knee against
another person, who was also mounted and passing in an op-
posite direction. He experienced acute pain, and cried out
that he was wounded. He was taken from his horse, car-
ried into a shop, and laid upon a mattress. A surgeon, who
arrived, found the patella completely luxated, and endea-
voured to reduce it. For this purpose he placed the limb

upon a horizontal plane, drew the extensor muscles to-
ward their insertions, and had recourse to extension, as di-
rected by Platner. Notwithstanding his best directed efforts,
the patella remained jammed against the external condyle.
He next tried to place the Count upon his feet, but the at-
tempt excited excruciating pain. In this dilemma, the
Count's family surgeon, M. Veyret, arrived. He took
hold of the heel with his left hand, and raised the whole
limb, pressing against the patella with the other hand. The
leg being thus brought nearly to a right angle with the body,
the patella became vacillating, and was easily reduced by
pushing it toward the internal side of the knee.* The
Count got up, limped across the room, and got into his car-
riage without much difficulty, and the pain was compara-
tively trifling. A bleeding, and the application of com-
presses wet with a resolvent liquid, completed the cure; and
not the slightest pain was afterwards felt in the knee.

Ravaton relates, in his book, entitled, The Modern Prac-
tice of Surgery, the case of a dragoon, who, while mounted
on a spirited horse, rubbed the right patella against a wall,
and luxated it outward. It projected more than three inches.
The man was immediately brought to the hospital. Rava-
ton reduced the luxation, after several trials, and the patient
was entirely cured in three weeks.

In the course of a long practice, I have only seen the pa-
tella once luxated. A large young man, sixteen or eighteen
years of age, fell in running along a corridor, and struck
the inner side of his knee against the corner of a trunk,
which caused an incomplete dislocation of the patella out-
ward. The family surgeon was sent for, and he requested
the assistance of M. Sabatier. This celebrated professor,
after having considered attentively the symptoms of the ac-
cident, discovered its true nature, and endeavoured to re-
medy it; but not succeeding, I was called in. The patient
lay upon a bed, with his leg extended, and resting upon pil-
lows. The patella formed a tumour in front of the external
side of the articular pulley of the femur. Before this last
named part there was a depression. The anterior surface
of the patella was inclined inward, and its external edge
forward. In the third attempt, I reduced the luxation, in
the manner I have laid down. The joint was kept wet with
resolvent liquids, and the young man was confined to his bed
for eight days, and the cure was complete.

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* See note I.

A great relaxation or elongation of the ligament of the patella, especially if connected with a vicious conformation of the condyles of the femur, may dispose it to spontaneous luxation. M. Itard has related the case of a child of twelve years of age,* of a delicate and feeble constitution, who luxated the right patella outward while fencing. The patient heard a crack like that caused by the drawing of a tooth ; the pain led him to put his hand to his knee ; he lost his equilibrium, and fell. The boy reduced the luxation himself. He was carried to his bed, and confined there three weeks ; during which time topical applications were made use of. Four months afterwards, the left knee-pan was dislocated outward, in the boy's attempts to imitate the noise of a galloping horse by striking his feet upon the ground. This accident was treated like the other. At the end of three years, the right patella was again luxated by a fatiguing walk. M. Itard was called in to assist in devising a bandage, which the surgeons recommended. Upon examination of the child's knees, he found a remarkable prominence of the patella, which was turned out in such a way that the anterior surface tended to become the external ; the knee was oval instead of round—a circumstance which was owing to the ascension of the patella along the articular groove, and from which arose the facility with which it was luxated. M. Itard conceived that the cause of all these phenomena was a relaxation or stretching of the ligament of the patella, and devised a mechanical bandage to prevent its further elongation. The constant application of this was attended with complete success.

We believe, that the simple relaxation of the ligaments of the patella is not enough to dispose to a luxation of that bone : it must be connected with a vicious formation of the condyles. But authors have not attended to this circumstance ; and Heister, who relates that he saw a young man in whom the ligaments were so lax, that he could dislocate the patella, and replace it at pleasure, says nothing in relation to the form of the condyles, or the kind of displacement of which the patella was susceptible.

I know a young man, about twenty years old, who frequently luxates the patella outwards, while walking, and while the leg is in certain positions. He easily replaces it, but the dislocation is always attended with pain and swelling, which render walking difficult ; but they subside in a few days. I have succeeded in preventing the recurrence of

these accidents, by means of a laced knee-cap, made of chamois leather.

The external edge of the articular pulley of the femur, naturally more prominent than the internal, may be so much depressed, that when the leg is extended, instead of rising in the direction of the groove of the joint, it goes to the outer side. I have seen a child, eight or nine years old, in this situation. The patella was luxated outward every time he extended the leg—but the strength of the limb was not diminished, and the child walked perfectly well.

In persons in whom the patella is occasionally luxated outwards, after a length of time, the knee is remarkably weakened, and the whole limb becomes smaller than the other. In recent cases, a knee-cap would prevent the patella from being luxated; but no means are successful in those of long standing. Moreover, the luxation gives so little inconvenience, that medical men are not generally consulted.

CHAPTER XXXVII.

Of Luxations of the Tibia and Fibula.

THE tibia may be luxated in four different directions, and its luxations may be complete or incomplete. The former are extremely rare.

Heister says he reduced a complete luxation of the tibia backward in a fat robust man. It appears to us impossible that any complete luxation of the tibia backward should take place. We regret that Heister has not described his case more particularly. He merely observes, that no bad consequences followed the accident; merely a swelling and pain in the knee, which continued for a long time, and were removed by resolvent applications. The tibia is luxated backward in certain cases of white-swelling.

The luxation of the tibia forwards is still more difficult than that backward.

Lateral luxations are more common than the others: they are almost always incomplete; and the external condyle of the tibia is placed below the internal condyle of the femur in the luxation inward, and *vice versa.*

In whatever side the tibia is luxated, the patella is always drawn with it, and is more or less displaced.

The 402d case of Lamotte is an example of a complete luxation of the tibia outward: " A labourer sunk beneath a pile of earth, which fell upon him, and principally upon the lower half of his body. The right thigh and leg being supported by a solid plane below, were only bruised; but the extremity of the left thigh being raised by a little mound of earth, the upper part of the leg did not touch the ground, and was, consequently, luxated backward."

A man was turning the wheel of a crane, by putting his feet alternately upon the spokes. The right foot having slipped, the left was caught between two spokes, and was carried inward, while the weight of the body drew the thigh in a contrary direction. These two cases illustrate the two modes in which the luxation of the tibia may be occasioned.

In the luxation backward, we find the leg bent at a very acute angle, and incapable of being extended; the condyles of the femur and the patella form a round tumour, which terminates the thigh. Below this tumour is a depression, in which we may feel the ligament of the patella lengthened and tense; the hollow of the ham is filled by the upper extremity of the tibia, which forms a remarkable tumour at the lower and posterior part of the thigh.

The extensive destruction of the soft parts, which necessarily attends luxation forward, renders the diagnosis of this accident very easy.

As to the diagnosis of lateral luxations of the tibia, the change of the direction of the axis of the tibia, with respect to that of the femur, renders it perfectly evident.

Almost all authors agree, that complete luxations of the tibia lead to the necessity of amputation; and that, when this operation is not performed, the most favourable result we can hope for is anchylosis, which often takes place even after incomplete luxations. Yet there are exceptions to the ordinary termination of these accidents. Lamotte's patient was able to return to work at the end of five weeks. Heister's case of complete luxation backward is reported to have terminated in a perfect cure. In the incomplete luxation inward which occurred to us, the patient could walk about, and work, at the end of three weeks.

The reduction of luxations of the tibia is seldom difficult: An assistant takes hold of the lower part of the leg with both hands, to make the extension; another grasps the lower part of the thigh. The extension should be made in the di-

rection in which the leg is thrown by the accident: when it is sufficient, the surgeon, stationed on the outside of the limb, places one hand on the condyles of the femur, and the other on the upper part of the tibia, and acts in contrary directions. The patella follows the tibia in its return to its place; a noise is heard at the moment of the reduction, and the leg becomes capable of flexion and extension.

After the reduction, the knee should be covered with compresses wet with a resolvent liquid: these should be kept on by a roller, which is sufficient to prevent a recurrence of the accident; but, if there be a strong tendency to displacement, as I once saw after an incomplete luxation inwards, splints and pillows of chaff will be necessary, as in fracture of the thigh, and some degree of compression should be exercised on the side toward which the bone was dislocated.

In the treatment of luxations of the tibia, it is of great importance to moderate the inflammatory symptoms. Bleeding, and the anti-phlogistic regimen, are indispensable. Resolvent and repellent applications should be applied in the first instance. When inflammation and tension have come on, emollient poultices are proper. Resolution generally follows; but, in some cases, suppuration, and even gangrene, supervene. The moment the formation of pus is ascertained, we should make suitable openings, to prevent it from lodging in the joint. Amputation is the only resource after gangrene has taken place.

The question has been discussed, whether amputation is not always proper immediately after complete luxation of the tibia: We think a prudent surgeon will not perform the operation, except in cases where the injury of the knee is so great as to render gangrene inevitable; and such cases very rarely occur.

Of Luxations of the Fibula.

Most authors who have written treatises on diseases of the bones, and general systems of surgery, seem to have considered luxations of the fibula as hardly possible.

The upper extremity is capable of slipping backward or forward, and might be luxated in these two directions, if its unusual size should, in any way, expose it to the action of external violence, acting in these directions: there would be no difficulty in pushing it back to its place.

The lower end of the fibula is so strongly articulated with the tibia, that it cannot move, except by the yielding of its

ligaments. If these ligaments, and those which surround
its upper articulation, are relaxed, the articular surfaces
have a direction more nearly vertical; under these circum-
stances, if the foot be slightly twisted outward, the fibula,
instead of being broken, as generally happens, may slip bo-
dily upward. We have seen a luxation of this kind, in con-
sequence of a luxation of the foot outward. The two luxa-
tions were reduced at the same time; by bringing the foot
to its natural direction, the fibula was also replaced, and the
patient recovered with a slight stiffness of the joint. This
luxation is the only one of which the lower extremity of the
fibula is susceptible.

CHAPTER XXXVIII.

Of Luxations of the Foot.

THE astragalus is received into a quadrilateral cavity,
formed by the inferior extremities of the tibia and
fibula, and exactly fills the space between the two malleoli;
the external of which is lower than the internal. The joint
of the foot is surrounded by a thin capsule, and is strength-
ened by a large and thick internal lateral ligament, by three
external lateral ligaments, and by the tendons of the ex-
tensor and flexor muscles of the foot and toes. It permits
no other movements than those of flexion and extension:
The astragalus, confined on the sides by the malleoli and la-
teral ligaments, cannot move inward or outward, except by
the yielding of the ligaments that unite the inferior extre-
mities of the tibia and fibula to these movements, which are
extremely circumscribed. The lateral movements of the
foot do not take place in its articulation with the leg, but in
that of the astragalus with the scaphoides and os calcis, and
of this last with the cuboides. The movement by which the
sole of the foot is turned inward, and its internal edge up-
ward, is easier and more extensive than that in an inverse
direction. Thus we see, that, in the violent turning of the
foot inward and outward, the effort is supported by the arti-
culation of the tibia and fibula with the astragalus, and by
that of the os calcis and scaphoides. It is, therefore, re-
marked, that luxation of the astragalus upon the bones of

the leg is sometimes complicated with that of these bones upon the os calcis and scaphoides.

The foot may be luxated inward, outward, backward, and forward. In whatever direction the luxation takes place, it may be simple or complicated, complete or incomplete. Luxations forward and backward are less frequent than those outward and inward: this last is most common.

In the luxation inwards, the astragalus is turned upside-down; the articular surface of its internal side, which, in its natural state, touches the internal ankle, is turned downward, and thrown below that eminence, while its superior surface is turned inward, and its external upward: the external malleolus is approximated to the external edge of the foot, which is raised, while its internal side is sunk. This change of direction of the astragalus is more or less considerable, according to the extent of the displacement. In luxation outward, the astragalus is displaced in a contrary direction, so that the superior surface becomes the external, the internal the superior, and the external the inferior.

Lateral luxation of the foot may be simple or complicated. It is simple when the ligaments that surround the articulation have yielded, without being much broken, and the other soft parts have only experienced the stretching and distension inseparable from a dislocation of a ginglymoid articulation. Lateral displacements of the foot may be complicated with rupture, or unusual distension of the ligaments, separation of the fibula, fracture of the malleoli, projection of the astragalus upon the os calcis and scaphoides, &c.

The astralagus has been fractured in the place where its head unites with its body; so that this last part was entirely isolated, and could easily be taken away. These different complications are common to luxations inward and outward; fractures of the malleoli and luxations of the astragalus upon the scaphoides and os calcis are however more frequent in the first than in the last case.

Lateral luxation of the foot happen by the turning this part inward and outward; but for the power that causes this to produce a luxation, it must act with sufficient force, break the lateral ligaments and those of the malleoli. Thus these luxations seldom happen, except in falls from elevated places, when one of the edges of the foot does not touch the ground, or while the foot is violently pushed to one side, while the weight of the body, or any other cause, draws the leg to the opposite side.

The deformity and impossibility of moving the foot are

sufficiently characteristic of its lateral luxations. In that inward, the superior surface of the foot is directed inward, and the superior outward; the astragalus forms a tumour under the internal malleolus. In luxation outward, the foot is adducted, so that the surface of the sole is directed inward; the astragalus forms an eminence under the external ankle. These changes of direction of the foot are so apparent, that it is impossible to mistake the luxation, even if considerable swelling has taken place; this swelling, may, however, render the diagnosis difficult in the different complications of which lateral luxations of the foot are susceptible.

We judge that the malleoli are fractured by their mobility, and the crepitation heard when they are compressed. Fracture of the external malleolus, which frequently accompanies luxation inward, is, however, sometimes so concealed by the swelling of the soft parts, that it is impossible to discover it. In cases of doubt, we must conduct as if the fracture was evident, and pursue the proper means to prevent a consecutive deviation of the foot outward. Complication of diastasis, in this kind of displacement, is known by the mobility of the inferior extremity of the fibula when the luxation is reduced.

The astragalus cannot be luxated without a simultaneous distension and rupture of the ligaments and the adjacent soft parts. Hence the inflammation that generally accompanies these luxations may lead to the necessity of amputation, in order to save the life of the patient. In less serious cases, we have always to fear stiffness of the joint, or even its anchylosis. In other instances, after luxation the integuments are feeble, and repetition of the displacement is frequent, if the patient do not use some mechanical means to support the foot at the sides.

All lateral luxations are not equally serious; those which are incomplete are least dangerous: they are generally cured in a short time, without any feebleness or stiffness in the limb. Complete luxations, accompanied with fracture, are not always the most serious, provided the fracture be simple, without splintering of the bone. Lateral luxations of the foot, complicated with that of the astragalus on the os calcis and scaphoides; and the issue of the first of these bones through a wound of the integuments, would appear to produce the most formidable accidents, and require amputation; however, a great number of examples are known, in which the astragalus has been removed, and the patient cured.

Lateral luxations of the foot must be reduced without de-
lay, otherwise the inflammatory swelling renders the reduc-
tion painful and difficult. The patient should be laid on a
bed; an assistant takes hold of the inferior part of the leg
with both hands. to make the counter-extension; another
assistant seizes the foot with both hands, to make the exten-
sion. The counter-extension must be made in the direction
of the leg, while the extension draws the leg, first in the di-
rection the displacement has given it; and, when the liga-
ments and tendons yield. the bone should be pushed in a con-
trary direction to that given it during the dislocation. This
manœuvre is generally sufficient to effect the reduction. If
the foot is luxated outward. the surgeon takes hold of the
lower part of the leg with one hand, the thumb being placed
above the external malleolus, and, at the same time, he
pushes the lower part of the leg inwards, and turns the sole
of the foot outwards. In a luxation inward, an inverse me-
thod is to be pursued.

When the luxation is reduced, the articulation is to be co-
vered with oblong compresses wet with a resolvent liquid,
which are to be kept on by means of a bandage, applied in the
form of a figure of 8, passing alternately over the foot and
under the sole; pillows of chaff and splints of wood are then
placed on the sides of the limb, and fixed as in a fracture of
the leg, so as to keep the foot in its natural position.

In all lateral luxations of the foot, inflammation is to be
feared, and we must endeavour to prevent it by bleeding and
prescribing a severe diet and cooling drinks. If there is
neither pain nor swelling, resolvent fomentations are to be
continued; the dressings should be renewed every five or six
days, and as soon as the state of the parts will permit,
slight movements should be given the foot, to prevent stiff-
ness in the joint.

If pain and swelling have taken place, bleeding must be
continued. leeches must be applied around the articulation,
and emollient and anodyne poultices directed. The patient
must not be permitted to walk until the distended or broken
ligaments are united, which is generally in about a month or
six weeks.

In luxation complicated with diastasis of the bones of the
leg, compression, strong enough to keep them pressed toge-
ther, must be made on the superior extremity of the bones
and continued until the perfect re-union of the torn liga-
ments takes place.

Lateral luxations of the foot, accompanied with fracture
of the inferior extremity of the fibula, require great at-

tention. When the fracture is not discovered, or the luxa-
tion is not reduced, the astragalus not being held by the ex-
ternal malleolus, the foot becomes drawn outward by the
action of the muscles, and luxation is insensibly reproduced;
and, if this displacement is not perceived in time, it becomes
impossible to remedy it, and the patient becomes lame. The
slow and gradual deviation of the astragalus from its proper
position is sometimes accompanied with inflammation, ulce-
ration, and mortification of the skin on the inner side of the
joint. If the ulceration penetrates to the articulation, the
limb, and even the life of the patient, may be lost. In case
of luxation of the foot and fracture of the inferior extremity
of the fibula, after reducing the fracture, the foot must be
kept in its natural direction, by placing splints on the sides
of the leg; the external one passing beyond the sole of the
foot, and the internal one not lower than the malleolus; the
compression of the splint on the outer side of the foot should
be strongest.

Luxations complicated with rupture of most of the liga-
ments, of the tendons, and of the skin, or issue of the astra-
galus, or of the inferior extremity of the tibia, through a
wound of the integuments, must be carefully examined for us
to determine if amputation of the limb is the only resource to
save the life of the patient. This is a case which requires
the greatest judgment and experience. If, after maturely
examining all the circumstances of the case, it appears that
amputation is the only means of saving the life of the pati-
ent, the operation must be performed immediately, for delay
renders it almost always useless, and the patient expires.

If an attempt to preserve the limb is deemed advisable,
when the astralagus has come through the wound of the in-
teguments, and is confined in the passage, so that it is im-
possible to replace it, the opening of the wound must be so
enlarged as to render the replacing of the bone easy. The
same conduct is to be observed when the inferior extremity
of the tibia has come through the skin, and the opening of
the ligaments is not sufficiently large to permit it to return
to its natural place.

When luxation of the foot is accompanied by that of the
astragalus on the os calcis and scaphoides, and the first of
these bones has almost totally escaped by a large wound of
the teguments, and the ligaments that united the two others
are broken, it must be extracted by dividing the small
portion of ligaments that yet hold it; for, in this case, the
astragalus may be considered as a foreign body. After this
operation, the tibia approaches the os calcis, the soft parts

that surround the articulation experience a relaxation that
diminishes the pain and inflammatory tension; the large
space, resulting from this extraction, quickly diminishes;
the articular surfaces of the tibia, the fibula, and os calcis,
are soon covered with granulations; which unite, and the
bones of the leg grow to the os calcis. The movements of
the foot are lost, and the limb is shortened by the height of
the astragalus, the patient walks tolerably well notwith-
standing.

The advantages of the extraction of the astragalus in this
case is proved by a great number of facts. Fabricius
Hildanus reports, that a minister, in jumping over a
hedge three feet high, completely dislocated the astragalus:
it projected through the skin, and was held only by some
fibres. The surgeon removed it, and employed the proper
means to combat the inflammation. The patient walked
without a stick, but with difficulty, and after a long confine-
ment. M. Aubray, then surgeon in chief of the Hotel Dieu
of Caen, relates a case of luxation of the foot, without
fracture of the astragalus, in which, on the ninth day of
the accident, after having made deep scarifications on the
malleoli, and extracted some splinters of the fibula, he was
astonished to perceive the astragalus out of its place, pre-
senting its trochlea, and making a right angle with the tibia.
He immediately unbridled the wound, and isolated the bone,
which appeared fractured in the middle of the anterior pro-
cess that unites it to the scaphoides. Two days after-
wards he extracted the astragalus. The following day, the
fever and swelling considerably diminished. Some purulent
effusions were the only consequences that retarded the cure,
which was complete at the end of three months, except an
anchylosis of the foot; that did not prevent the patient from
walking with ease and without help.

We have heard Ferrand, surgeon in chief of the Hotel
Dieu of Paris, say, he successfully extracted the astraga-
lus, in a luxation of the foot when this bone came through
the skin; the patient, an officer of Invalids, who, after the
cure, used to carry the bone in his pocket, to show as a proof
of the danger of his wound.

Desault three times extracted the astragalus with success.
One of the patients, a woman of fifty years of age, died,
however, two months after the accident, of hospital fever.
Being charged to dissect the limb, I remarked that the ti-
bia was already almost entirely united to the os calcis, and
there was not the smallest doubt but the patient would have
recovered with an anchylosis, had she not died of another

disease. The same practitioner saw the extraction of the astragalus succeed in the practice of other surgeons.

We read, in the " Medicine eclairée par les Sciences Physiques,"* &c. by Fourcroy, a case of a complete luxation of the astragalus, and its extraction, by M. Laumonier, surgeon in chief of the hospital of Rouen.

On the 5th of August, 1790, Andrew Houdan was thrown from the back of a carriage by a violent jolt; the right leg having got entangled in the spokes of the wheel while turning, it twisted the articulation of the foot, and luxated the astragalus, by separating it from the tibia, fibula, and os calcis. Fifteen days after the accident, and after several attempts at reduction, the patient was brought to the hospital of Rouen. The scaphoidien surface of the astragalus was black; the leg and foot very much swollen; the patient was pale, bloated, and feverish. The astragalus appeared to M. Laumonier to be altogether a foreign body, which it was proper to extract; the operation was performed on the day after the patient's entrance into the hospital, and was soon followed by a sensible melioration. But, on the eighth day, an abscess suddenly formed on the external ankle, the top of the foot, and the peroneus brevis; a counter opening removed the fever which accompanied the formation of matter: from that time the patient went on improving. When M. Laumonier communicated the case to the Royal Society of Medicine, he hoped his patient would be able to use his foot, notwithstanding the loss of the astragalus, the posterior tendons of the leg, and the long flexor of the toes.

A similar case was communicated to the same society by M. Mauduyt: A soldier, thirty years of age, was severely wounded in the foot by jumping over a wall that enclosed the town. A bone had pierced the teguments, and was partly outside: the surgeon, thinking it could not be replaced, cut the ligaments that were partly broken, and took it out.

The cure was long and difficult: the patient could not walk until after eighteen months, and then slow and by leaning on a cane. M. Mauduyt saw the bone come out of the foot, and knew it to be the astragalus.

Finally, M. Deniel has inserted, in the periodical collection of the Society of Medicine, a case of luxation of the foot, with issue of the astragalus, by a wound near the external malleolus. The author of this communication, notwithstanding the opinion of his two associates, who were for amputation, decided to extract the astragalus the eighth

day after the accident. At the end of three months and an half, the patient walked, with the assistance of a stick.

It will be seen, from the examples we have cited, that the astragalus has been extracted, at periods more or less distant, after the wound happened, and during the presence of severe constitutional irritation ; that this extraction was easy, not painful, and constantly followed by a diminution of the symptoms ; and, lastly, that the patients recovered with anchylosis of the foot, and could walk with facility, at first by the assistance of a cane, and, finally, without any help. We ought then, under similar circumstances, never to hesitate to extract the astragalus ; for this is preferable to amputation, which was formerly regarded as the only resource in such cases.

In the different complications of the lateral luxation of the foot, after having effected the reduction, and applied the proper apparatus to keep the foot in its natural position, we should employ the most energetic anti-phlogistic means to combat the inflammation that always accompanies these accidents, and which, notwithstanding the best treatment, may terminate in gangrene or suppuration.

Gangrene, provided it is confined to the skin, does not prevent the cure, but, when it extends to the bone, its progress is sometimes so rapid, that the patient quickly expires. At other times, the mortification stops, and nature draws a line between the living and dead parts. We have then the resource of amputation.

When an abscess is formed, it must be opened early ; the matter is generally near the joint, and under the skin, but sometimes it is seated more deeply between the muscles, as may be seen in the 410th case of Lamotte : In a luxation of the left foot, the inferior extremity of the tibia projected through the integuments, the fibula was broken two fingers' breadth above the external ankle, and the foot bent back against the external middle part of the leg. The luxation was easily reduced ; violent inflammatory swelling followed ; three abscesses were formed ; the principal one was between the gastrocnemii and the plantaris, another at the internal superior part of the leg, and the third on its external superior part. These abscesses retarded the cure, which was not complete until the end of seven or eight months.

When luxation of the foot is complicated with issue of the inferior extremity of the tibia, through a wound of the skin, if a part of the bone is denuded, it is sometimes covered with granulations, without exfoliation ; sometimes

these granulations do not appear until a part of the unco-
vered bone mortifies and exfoliates: but, when all the cir-
cumference of the bone is denuded, if we leave the sepa-
ration to nature, it will not be effected in a long time, dur-
ing which the patient is exposed to symptoms that may de-
stroy him. To prevent these, and, at the same time, to ac-
celerate the cure, M. Deschamps, surgeon in chief of the
Charité, determined to perform the resection of the inferior
extremity of the tibia. He communicated the following case
to the Society of Medicine of Paris, in 1811: "A man,
thirty-two years of age, being thrown on his left side, re-
ceived the momentum of a large piece of timber, on the
right internal ankle. The third day after, M. Deschamps
found the articulation of the foot completely opened in its
anterior parts; the trochlea of the astragalus was denuded;
the internal malleolus was separated in a line almost trans-
verse to the tibia; the fibula was fractured, and the integu-
ments wounded near the lower third of the bone; one of the
fragments projected outward; the foot was turned outward,
and although the swelling extended to the lower part of the
leg, the pain was not violent, and the patient was without
fever. After having separated the fractured parts of the
malleolus, he left the parts as he found them. The wound
was covered with emollient poultices, changed twice a day.
Twenty days after the accident, the wound was in a good
way, but the tibia was two inches and three-fourths longer
than the articulation. M. Deschamps performed the re-
section in a particular manner. He then sawed the extre-
mity of the bone almost in contact with the astragalus,
which permitted him to place the foot inward into its natural
situation. Every thing went on well, and, six months after-
wards, the wound was entirely cicatrized. The wound, cor-
responding to the fracture of the fibula, the fragments of
which overlapped each other, did not close until a month af-
ter: the foot acquired strength; the patient wore a boot
with a very thick sole, to support the foot, and on this he
walked.

Anchylosis being inevitable after removing either the as-
tragalus or the inferior extremity of the tibia, and much to
be feared after all luxations, the foot must be kept at a right
angle with the leg, to favour the exercise of its functions
after the cure.

In complicated luxations of the foot, when there is no ex-
ternal wound, (a case extremely embarrassing and dan-
gerous,) the reduction must be attempted immediately. It is
generally very difficult, and sometimes impossible. The diffi-

culty does not arise from the head of the bone being confined
in the narrow opening of the capsule, but from the astraga-
lus being luxated on the tibia and the scaphoides, the ex-
tending powers do not act on this bone, and the hand of
the surgeon cannot push it into its natural place.   Desault,
unable to reduce a luxation of this kind by the usual method,
and attributing his ill success to the narrow opening the as-
tragalus had made in the capsule, laid the bone bare, and di-
vided the ligaments, and then reduced the luxation with
care.   We also find, in the Surgical Journal of the same
practitioner, another case of double luxation of the astraga-
lus, without wound : but in this Desault effected the reduc-
tion with great facility, and the patient was cured on the
thirty-ninth day.   It is probable, that, in these two cases,
the astragalus was so moveable that the pressure of the fin-
gers was sufficient to push it into its natural place : but the
astragalus may be so wedged between the tibia and os calcis,
that it is impossible to reduce it, as in the following case.

A man, thirty-six years of age, small, but very strong,
fell from a horse : his foot was entangled in the stirrups,
while the horse continued galloping : the astragalus was
turned over inward upon the tibia, and its head left the sca-
phoides by the superior external part of the cavity of this
bone, and formed a remarkable tumour under the skin.
The patient was brought to the Charité, directly after the
accident : I immediately attempted the reduction, but all my
efforts were useless ; the astragalus was immovable, and did
not yield to the pressure I exercised on it, while two strong
assistants made the extension and counter-extension.   The
patient suffered very little, and I determined to abandon the
luxation to itself, hoping, that if I prevented inflammation,
the astragalus would unite to the bones between which it was
confined, and the patient have the use of his foot, although
deformed and turned outward.   This appeared to me prefer-
able to amputation, or incision of the skin and ligaments,
because, from the fixed state of the astragalus, an incision
would not render the reduction possible, and I feared the
consequences of opening the joint.   The part was covered
with emollient poultices, and the limb placed in the appara-
tus for fractures ; the patient was put on the anti-phlogistic
regimen, and bled three times in twenty-four hours ; there
was very little swelling ; the pain was moderate, and, until
the eighteenth day, hopes were entertained of a favourable
termination ; but, at this period, the skin that covered the
tumour formed by the head of the astragalus and behind the
external malleolus, began to turn red ; a gangrenous eschar

soon appeared in these two places: the fall of the one cor-
responding to the head of the astragalus, left the cartilage
uncovered, already yellow and rough; the ulcer resulting
from this eschar furnished a viscid yellow matter, proceed-
ing from the destroyed synovia. At about the end of nine
months, the pain became extremely violent, the suppuration
very abundant, and of bad quality; a slow fever took
place; the patient was sinking rapidly; amputation then ap-
peared the only means of saving his life: it was performed
with success. An anatomical examination showed the dou-
ble luxation of the astragalus, and the articular surfaces of
this bone carious, as likewise those of the tibia and fibula.

Luxations of the foot forward and backward are much
more rare than those to one side: the luxation forward is
less frequent than that backward.

In the displacement backward, the trochlea of the astraga-
lus is lodged behind the inferior extremity of the tibia, which
rests on the neck and head of the former bone: in the luxation
forward, the inferior extremity of the tibia is behind the
trochlea of the astragalus, and corresponds to the posterior
part of the superior surface of the os calcis: in both cases
the capsular ligaments are ruptured, and the lateral liga-
ments are partly or wholly broken.

It is commonly said, that luxation backward takes place
when the foot is very much bent; but flexion of the foot can
never be carried far enough to cause this luxation; which,
indeed, can scarcely happen, except in a fall or a jump on
the feet, when they are forcibly extended, and strike against
an inclined plane. In these circumstances, if the weight of
the body is born more on one foot than on the other, and
the body, the thigh, and the leg so erect that the line of
gravity of the superior parts fall on the articular pulley of
the astragalus, the tibia, the axis of which is then very
oblique to this pulley, may slide downward and backward.
In this manner the only luxation of the astragalus backward
that I have met with took place.

The characteristics of these luxations are so evident that
it is difficult to mistake them. The following case, how-
ever, is an example to the contrary: A man fell on his feet,
from a height of six feet: the weight of the body was re-
ceived principally upon the right foot, the sole of which, in
its whole extent, struck upon an inclined plane; the inferior
extremity of the tibia passed downward and forward upon
the anterior pulley of the astragalus; so that this bone
was luxated backward. The accident was taken for a

sprain, and treated accordingly. I saw the patient a month
after it had happened: the reduction was then impossible:
I endeavoured to dissipate the swelling, which still existed:
the movements of flexion and extension were almost entirely
lost, and the patient walked afterwards as a person whose
foot is anchylosed with the leg.

Luxations of the foot backward and forward are, in gene-
ral, less serious than lateral luxations; when they are not
reduced, the limb is not rendered useless, but its functions
are performed with difficulty.

To reduce luxations forward and backward, extension
and counter-extension are necessary. In the latter accident,
the foot must be pushed forward by one hand placed on the
heel, and another on the lower part of the leg, which should
be pushed backward, and *vice versa.*

The after treatment is the same as in lateral luxations.

We have already seen, that the astragalus, luxated in-
ward or outward on the tibia, may be, at the same time,
luxated on the os calcis. Independent of this mode of dis-
placement, the astragalus may be luxated on the scaphoides,
and preserve its natural relations with the bones of the leg
and the os calcis: in this case, the os cuboides also must be
luxated on the os calcis. J. L. Petit twice met with this ac-
cident: in both instances it was occasioned by entangling the
foot in the bar of iron that forms the bridge over the small
gutter at a gate-way. It is to be regretted, that this great
practitioner does not mention the appearances of these lux-
ations, and the means he employed to reduce them. He
merely says, the accident is only known by the deformity
that indicates where the bones are lodged; and, in speaking
of the prognosis, that this luxation is less apt to produce
bad symptoms than that of the foot; but the reduction is
more difficult, because we have less hold to make the exten-
sions. I have seen incomplete luxation of the head of the
astragalus in a man who fell from a house; the inflamma-
tion was so great as to conceal the displacement at first, and
when I could ascertain it by the tumour formed by the head
of the astragalus, it was impossible to replace it: the move-
ments of the foot were incommoded for a long time, be-
cause the ankle joint had been sprained, but not the small-
est deformity remained.

The phalanges of the toes are very rarely luxated. All
we have said of dislocations of the phalanges of the fingers
applies to those of the toes.

CHAPTER XXXIX.

Of Wounds of the Joints.

THE opening of the capsule is what constitutes a wound
of a joint. There are many varieties of these acci-
dents. In this chapter we shall treat of wounds of the ar-
ticulations made by puncturing or cutting instruments, and
we shall consider them both in relation to the instrument
which has produced them, and the circumstance which ac-
company them. We refer the reader to the chapter on
sprains for what relates to contusions of the articulations,
and to the article on gun-shot wounds, for the rules of prac-
tice in contused wounds of the joints.

Of Simple Punctured Wounds.

Wounds made by puncturing instruments, without injury
of any considerable nerve, or of a cartilage or bone, merely
require to be placed in apposition.

A surgeon determines whether a wound penetrates a joint
by considering its direction, and comparing its extent with
the form and breadth of the instrument. If synovia escape,
the case admits of no doubt; but, in oblique wounds, this
circumstance does not always take place. A viscid fluid
may be discharged from the sheath of a tendon; we should
not mistake this for synovia. In examining a wound near a
joint, we should never introduce a probe : it might produce
a very dangerous degree of irritation, and would separate
the tender adhesions, which, perhaps, may have already
commenced: moreover, it is of no practical use to know if
the capsule is opened or not, for, in a doubtful case, we
should act as if it were.

In general, wounds of joints are not dangerous, if pro-
perly treated : nevertheless, as very slight accidents of this
kind have terminated fatally, we should be circumspect in
our prognostic.

The treatment of these wounds consists in approximating
their edges, and keeping them in this situation in order
to promote their re-union by the first intention. For this
purpose, the part should be so placed that the integuments
are relaxed; the lips of the wound should be brought toge-
ther by sticking plaster; the part is then to be covered with
compresses wet with a resolvent liquid, and over them a rol-
ler is to be placed, moderately tight. If we fear the pati-

ent may inconsiderately move the limb, we should take
means to keep it still, for the most perfect rest is necessary.
In the course of three or four days the wound is generally
found re-united: sometimes the bottom alone has adhered,
and the wound of the skin suppurates; but it heals soon af-
terwards.

CASE I. Mons. ―― had the left elbow joint opened, on
the inner side, between the olecranon and the internal con-
dyle of the humerus, by a very sharp piece of glass. The
escape of synovia left no doubt of the nature of the acci-
dent. I introduced a probe, and ascertained that there was
no piece of glass remaining in the wound, and then brought
its lips together with sticking plaster, and placed the fore-
arm in a sling, directing him to keep it quiet. The pa-
tient was perfectly cured in five or six days.

CASE II. A man, in a duel, had the elbow joint opened by
a small sword; synovia escaped. He was brought to the
Charité. I applied a plaster of diacholon cum gummis, and,
in a few days, he was perfectly well.

We shall have occasion to show that wounds of joints do
not always terminate so favourably.

Of Simple Incised Wounds.

Simple incised wounds require only to be kept in exact
apposition. If closed immediately, they generally do well,
unless blood is effused into the cavity of the joint. Com-
presses wet with a resolvent liquid, and a roller moderately
tight, should be applied; the most perfect rest should be
maintained; the patient should be put upon low diet, and,
if necessary, he should be bled.

CASE I. A man received a sabre-cut, which laid open al-
most all the posterior part of the wrist joint. The tendons
of the extensores carpi radiales were divided, and the action
of the antagonist muscles, together with the weight of the
hand, drew it to a state of flexion, so that the convexity
formed by the scaphoides, the semilunare, and the pyra-
midale, abandoned the cavity of the lower end of the ra-
dius, and could be seen at the bottom of the wound. The
man was immediately brought to me at the Charité: I closed
the wound, by placing the hand and fingers in a state of the
greatest extension possible, keeping them so by a suitable
bandage. The wound healed by the first intention, and the
man was completely cured in fifteen days; but I thought
proper to continue the use of the bandage fifteen days lon-
ger, to allow the tendons to unite more firmly. The pati-

ent was then allowed to move the hand, and, in a short time, it became as strong as the other.

CASE II. The wife of a shoemaker received a cut on the external side of the wrist. The tendons of the external radial muscles, of the abductor longus, the long and short extensors of the thumb, the radial artery, the external lateral ligament, and the capsule were divided; so that the outer third of the wrist joint was opened. A surgeon very improperly filled the wound with lint to arrest the hemorrhage. I saw the patient four or five hours after the accident. After I had removed the bandages, and washed away the blood with which it was filled, my first care was to tie the radial artery, which I did by catching it with a dissecting forceps; I then approximated the lips of the wound, by placing the hand in a state of strong abduction: the bottom of the wound healed by the first intention, but the external part did not heal before the end of a month. During all this time, the hand was constantly kept abducted. In order that the bandage might act more advantageously, I kept the fingers bent; the event showed that I did wrong, for the flexor muscles of the fingers became so much contracted that I was obliged to apply cones of linen, covered with cerate, gradually augmented in size, in order to straighten the fingers. A thread was attached to the apex of the cone, and passed between the fingers and palm of the hand, by means of an eyed probe; by drawing upon the ends of the thread the cone was conducted to its place. This contrivance has often succeeded on similar occasions.

Of Complicated Wounds of the Joints.

If a person receive a wound of a joint, however simple, although he may be in good health, if he does not keep the part in a state of the most perfect rest, we need not be surprised at the appearance of inflammation of the joint. The same thing will occur if there exist in the individual any of those morbid states of the system, which have been supposed to depend upon a taint of the fluids, a saburral state of the first passages, &c.

If we consider, that almost all wounds of joints that are immediately closed, and in which there is no particular circumstance to prevent adhesion, unite, by the first intention, and that in cases where wounds are not closed, the most serious symptoms follow, we cannot avoid attributing these consequences to the impression of air on the internal surface of the synovial membrane, and to the cartilages and fatty

substances within the joint. We know, by experience, that
the action of air on parts that are not naturally exposed to
it, and especially on serous membranes, is to excite inflam-
mation. The synovial membrane is still more easily sensi-
ble to the impression of the atmosphere ; but air cannot be
regarded as the only cause of inflammation of joints that
are wounded, for it often succeeds to wounds so narrow and
oblique that air cannot enter ; and, in other cases, inflamma-
tion takes place the day after the wound, too soon for air to
produce any noxious effects. We are pursuaded, that wounds
of the cartilages and bones, the improper application of lint,
and of acrid irritating substances to exposed joints, the
dressing necessary to stanch the blood, in cases which do
not admit of the application of the ligature, the morbid pre-
disposition of the patient, and errors in regimen, may all
combine with air in giving rise to inflammation : perhaps,
in some cases, it may arise exclusively from one of the above
named causes.

On the fifth or sixth day, in most cases, and sometimes
on the second or third, the inflammation commences. It be-
gins with acute pain, increased by the slightest motion ; the
joint swells and becomes hot ; the cellular tissue becomes
edamatous ; the skin is tense and shining, but not unusually
red ; the lips of the wound become pale, bloated, and thin,
serous pus distils from them ; the patient becomes fever-
ish ; his countenance animated and warm ; respiration is ac-
celerated ; the tongue is dry ; the thirst is very intense, and
sometimes delirium supervenes ; the swelling often extends
to the whole limb, which, in such cases, becomes prodigi-
ously swollen.

To these symptoms suppuration succeeds ; the joint is
filled with pus ; abscesses form, under the skin and between
the muscles, in parts more or less remote from the joint ;
the articular ligaments become relaxed ; the bones are
loosened, and the articular surfaces may be made to grate
upon each other ; the collection of pus increases, and ex-
tends, in some cases, to the trunk ; the patient suffers ex-
cruciating pain ; he cannot enjoy a moment's rest, and,
sooner or later, death closes the scene. If the strength of
the constitution have resisted the first symptoms, long-con-
tinued and copious suppuration, finally exhausts it ; the
features become sharp ; hectic fever insensibly steals on ;
diarrhœa and colliquative sweats supervene, and the patient
at length dies, unless we save him by a timely amputation.

In some fortunate causes, the disease yields to the efforts
of art ; the pains diminish, and finally case ; the pus becomes

less copious, and of better quality; sleep and appetite return to the patient; the edema of the limb subsides; the ulcers heal; and, finally, the articular surfaces becoming united to each other, the patient is cured with a stiff joint.

In forming our prognosis, we should consider the size of the joint and of the wound; whether the capsule only is divided, or whether the injury extends to the cartilages, bones, &c. We should reflect upon the state of the patient's health, the severity of the symptoms, &c. and from a consideration of all the circumstances of the case, decide on the propriety of amputating, and fix a proper time for doing it: never forgetting the necessity of extreme caution in giving our opinion as to the ultimate result of the case; for unpromising cases often do well, and others, apparently trifling, terminate in death or anchylosis.

The indication in the treatment of wounds of the joints, is, to diminish the inflammation and prevent suppuration; if pus is formed notwithstanding, we should prevent it from burrowing in or about the joint, and moderate the hectic symptoms which follow its absorption; we should bleed, according to the age and strength of the patient; prescribe cooling drinks, clysters and low diet, and, when the pain is excessive, even anodynes and opiates; the part should be placed in a suitable position, and kept in a state of the most perfect rest;—such are the means of procuring resolution. They often fail, and pus is formed: this must be discharged by making sufficient openings, and giving them an extent proportioned to the magnitude of the abscess. When the joint is large, the incisions should divide the capsule, so that the pus may flow out freely, or be washed away by injections. The exposure of the joint to the air is by no means so hurtful as the stagnation of pus within it.

Practitioners are not agreed as to the proper size of the incisions for evacuating pus from cavities that communicate with a joint. J. L. Petit advises, that they should be made large: "We should not only make openings," says he, "but make large openings, communicating with each other; so that every part of the joint may be washed by the injections. I know that the bones often become diseased and exfoliate; but this does not result from the presence of air admitted through the opening, but from the presence of pus in spite of the openings; we should, therefore, make early incisions, and wash the interior surface of the joint by means of injections." David, on the contrary, thinks we should not be in haste to evacuate pus from a joint; and that, when we can no longer delay discharging it, a trochar should

be employed. He says, he never saw any good result from
the large incisions recommended by Petit.

In our opinion, when an abscess of a joint has resulted
directly from the inflammation produced by a wound of the
capsule, or a contusion of the articulation, a comminutive
fracture, or a gun-shot wound, we should open it as soon as
fluctuation is apparent, and make the incisions large enough
to admit of washing away the pus by injections. Otherwise
caries of the bones and hectic fever will soon take place;
and, although we expose the joint to the air by this practice,
not so much injury results as would be occasioned by the
stagnation of pus. The advantages of this method are esta-
blished by very extensive experience.

But when an abscess is the consequence of caries of the
articular surfaces, as in white-swelling, disease of the hip-
joint, &c. we ought not to make an artificial opening, un-
less excruciating pains require it, or the formation of a na-
tural opening is threatened; and in these cases a simple
puncture is preferable to a large incision.

After an opening is made, we should place the limb in
such a position as will allow the pus to drain off, inject a
mild bland fluid, and exercise a moderate degree of com-
pression, if it can be borne. When the inflammation has
ceased, we should desist from the anti-phlogistic regimen,
and prescribe tonics—such as bitters, bark, succulent food
of easy digestion, a moderate quantity of old wine, and aug-
ment the allowance, if necessary, to prevent exhaustion.
Instead of emollient poultices, we should apply fomentations
of a decoction of Cinchona, with the addition of brandy,
&c. and, if new abscesses form, they should be opened, and
the dressings should be frequent, in proportion to the copi-
ousness of the suppuration.

When anchylosis is likely to result, the limb should be
placed, at an early period of the disease, in such a position
as will make it most useful: and, finally, when there is no
other probable means of saving the patient, we should ampu-
tate the limb.

CASE 1. A fencing-master had the articulation of the first
phalanx of the thumb with the first bone of the metacarpus
opened to the extent of six lines, by the point of a sabre.
He washed the wound with a mixture of water, brandy, and
salt. Four days passed without any remarkable occurrence.
The pressure of a hard body on the palm of the hand, at
the end of this time, excited hemorrhage and severe pain in
the wound; the swelling increased, and the man became fe-
verish, and entered the Charité. By moving the bones upon

each other I could perceive their grating ; several abscesses formed, and were successively opened. The thumb became anckylosed.

CASE II. A cabinet-maker divided the patella vertically by the blow of a hatchet. A surgeon applied the interrupted suture. Prodigious swelling followed, and mortification was threatened. M. Gelée was called in: he divided and removed the suture. He observed that the separation of the fragments of the patella increased the tension of the parts, and determined to cut away the smaller of the two. Emollient and resolvent applications were then applied ; the swelling continued, and, notwithstanding an ill-conditioned suppuration, the patient was cured with an anchylosis of the knee.*

CASE III. A young man received, in a duel, a sabre-cut, which laid open the shoulder-joint ; the scapular end of the clavicle, the deltoid, and a portion of the pectoralis major were divided. The patient was brought to the Charité immediately after the accident : I brought the lips of the wound together by raising the arm as much as possible, and placing pillows underneath it. He did well until the third day of the accident ; and I began to have hopes of saving his life, when a hemorrhage came on, which obliged me to remove the dressing : the bleeding vessel was so deep seated that I could not tie it ; I was obliged to fill the wound with lint ; inflammation and fever quickly followed ; considerable abscesses formed, which required several incisions, and the patient died at the end of four weeks. On dissection, the joint was found filled with pus, and its cartilages were diseased.

CASE IV. In 1790, a man was brought to the Charité who had just received a sabre cut that opened the right wrist, on the outer side, to a considerable extent. One of the sisters of the hospital, instead of closing the wound, filled it with lint ; the forearm and arm became prodigiously swollen, gangrene supervened, and the man died.

CASE V. A young man, aged eighteen years, received a sabre wound, which opened the elbow-joint and interested the external condyle of the humerus. The parts were not brought together before the second day: on the third, the pain was severe, and the man was restless ; on the fourth, there was so much swelling that I determined to substitute a poultice for the adhesive plasters ; on the fifth, there was considerable fever, a copious flow of a thick, viscid fluid,

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* Journal de Medicine Militaire, vol. iv. p. 508.

evidently synovia, took place; by pressing around the joint, a greater quantity of pus was made to escape; the symptoms continued to become more violent, and amputation at length became necessary to save the man's life.

Dissection of the limb. The edges of the wound formed a ridge infiltrated with lymph; the soft parts contained pus, the joint a sanious fluid; the external condyle of the humerus was entirely detached from the bone; disease was extending to the radius, and the cartilages were almost entirely destroyed.

CASE VI. A young man was brought to the Charité, in 1801, whose knee was laid open by a sabre wound, on the external and anterior part. I brought the lips of the wound together by sticking plaster; but the great tumefaction which took place rendered it necessary to substitute emollient poultices. Several bleedings, and the most severe antiphlogistic regimen did not prevent the swelling from extending to the leg; fever set in; the pain became excessive, and a large abscess formed between the femur and the triceps cruralis. The symptoms were exasperated on the following day, and the man died. On dissection, I found the patella completely divided, and the joint filled with pus.

CHAPTER XL.

Of Foreign Bodies formed in the Joints.

HARD, round, or flattened substances, generally cartila-
ginous, are sometimes formed in the joints.

The first example of articular concretions upon record is
mentioned by Ambrose Paré:* " In 1557," says he, " I
was requested by John Bourlier, a taylor, in the Rue St. Ho-
noré, to open a collection of water in his knee ; in which I
found a very white, hard, and polished stone, of the size of
an almond. The man got well, and is still living.

In 1691, Pechlin† published a detailed account of a carti-
laginous and bony concretion formed in the knee-joint, from
which it was extracted with success. The following is an
abstract of the case : A young man, aged twenty years,
well formed, and enjoying good health, fell upon the knee.
He was taken home, and the joint was examined : a dis-
placement of the bones being perceived, resolvent appli-
cations were made to the part ; the pain was dissipated,
and, at the end of some days, the patient could walk with
ease. Eight weeks afterwards, in handling the knee, he
perceived, on its internal side, a hard, moveable tubercle,
which, until then, had not caused any difficulty in walk-
ing. This body sometimes appeared suddenly above the pa-
tella, then below it, and sometimes at the sides ; but always
very near the ligament of that bone : occasionally it could
not be perceived at all. While the man was walking, he was
often obliged suddenly to stop, in order to keep himself from
falling : by gently pressing the knee, he displaced the body,
and recovered the use of the limb. Two years passed in
this way, when he perceived that the tubercle increased in
size, and consulted a surgeon. Various means were ineffec-
tually tried to soften the tumour, until the patient at length
insisted on having it extirpated, and the surgeon consented
to perform the operation. He pushed the foreign body on
the external side of the patella, toward the edge of the vas-
tus externus muscle, and stretching the skin tightly over it,
he made an incision through the integuments and capsular
ligament : the tubercle escaped, and with it a quantity of sy-
novia : it was as large as the end of the middle finger, and
its circumference was irregular ; by drying, it shrunk and

* Liv. xxv. chap. 15. p. 772.
† Observation Physico-Medic. Observ. xxxviii. p. 306.

lost its transparency: it was cartilaginous, but there were several ossified points.

Alexander Monro found, in the right knee of a woman who was executed, a bone, as large as a small bean, attached to a ligament, half an inch in length, and to the outer side of the tibia; the shell of this body alone was solid; the interior side of the tibia was filled with a cellular substance containing fat. On examining the cartilage which covers the outer side of the articular surface of the tibia, he found that it had lost a portion of its substance, corresponding to the foreign body just described. No account of the symptoms, during the life of the woman, could be procured.

Ten years afterwards, in the year 9736, Simson* extracted, from the left knee of a man, a large body, of the shape of a French bean, and larger. It was a bony concretion, covered with cartilage. This writer acknowledges, with candour, that he was mistaken, even during the operation, in regard to the true seat of the foreign body. He thought it was under the integuments, and he did not know that it was in the joint until he divided the capsule.

Since the publication of the last case, similar ones have been described by many surgeons in England, Germany, and France, and the disease is, at present, well understood.

Foreign bodies may be formed in any of the joints. Haller found twenty in that of the lower-jaw of a decrepid old woman, whose heart and arterial system presented evident traces of ossification. They have also been met with in the elbow, wrist, and ankle-joint: but the knee-joint is, by far, the most common seat of them, and our observations will be confined to this part.

Their size is various: Mr. Ford, an English surgeon, met with one as large as a chesnut, but this was of very unusual magnitude: Morgagni found five in the same joint no larger than raisin seeds.

Their shape is often like that of a bean: but this is subject to great variety. They are almost always smooth.

In some cases they are entirely detached; in other instances, they adhere to some part of the joint; generally, by a ligamentous thread, which allows them to move from one side to the other.

Sometimes they appear to be entirely cartilaginous; sometimes the centre is bony; sometimes soft and cellular; they are, in some instances, entirely composed of bone.

No swelling or dropsy usually takes place in the joint in

* Medical Essays of Edinburgh, vol. iv. 373.

which these bodies are formed : but there are a few exceptions to this remark.

Monro believed that these bodies were pieces of cartilage that had been detached from the joint ; some think that they are formed in the fatty substance, which is so abundant in the articulation of the knee ; others hold that they are composed of a collection of the particles which float in the synovia, in the same manner as urinary calculi are formed in the bladder ; Monro's hypothesis seems to be disproved by the fact, that the discovery of these bodies is not generally preceded by a fall or a blow.

The presumptive signs of the existence of one or more foreign bodies in a joint, are, acute pain suddenly coming on when the limb is moved in a particular direction, and rendering it completely immovable ; and a sudden cessation of the pain, and restoration of the limb to the easy exercise of its functions : the pain is sometimes so violent that patients, while walking, have been known to fall and faint, but others experience no pain. Bell speaks of a patient who suffered so acutely from a slight motion of the leg, that he used to awake from a deep sleep in excruciating pain ; to prevent which he kept himself perfectly at rest. The pain, which is caused by the pressure of the articular surfaces upon the foreign body, returns at intervals more or less distant, and is always brought on by some exertion.

These symptoms should lead us to examine the joint : If there be a foreign body within it, we shall probably feel it slipping under our fingers, from one side to the other, behind the patella, behind its ligament, and sometimes behind the extensor muscles of the leg. They are oftenest found on the inner side of the knee-joint, because there the capsule is most loose.

The treatment consists in fixing the bodies in some part of the joint where they will create no inconvenience, or in extracting them.

Reimarus[*] informs us, that Middleton, observing that one of his patients was not incommoded while the foreign body was under the patella, kept it in this situation by means of an adhesive plaster and a bandage, and, after several months, it could no longer be seen about the joint, and it appeared to have contracted adhesions. Middleton told Reimarus that he knew a similar instance of success, and that his treatment had failed in another case. Gooch tried

* De Tumore Ligamentorum circà artieulos, Fungo Articulorum dicte. S. 95.

it; and not hearing from his patient, concluded that he was relieved.

I directed a patient, who had a foreign body in the knee-joint, to wear a knee-cap. It enabled him to walk without pain: he wore it for one year, and afterwards never suffered any inconvenience. Another patient was also relieved for a time by the same treatment, but not having heard from him, I cannot say what has been the ultimate result.

It is impossible to say, whether compression produces an adhesion of the foreign body to any part of the joint. Its success is by no means certain: yet, as it is a perfectly safe remedy, we should always try it, in the first instance.

If it do not afford relief, and the patient is greatly incommoded, an operation is then justifiable. If the patient is in good health, he requires no preparation; if he is plethoric, it will be proper to bleed him; if he is subject to vague rheumatic pains, we should apply a blister to some remote part; the primæ viæ should always be cleansed by emetics and purgatives. The operation should not be performed during the prevalence of an epidemic which the patient might contract.

The apparatus necessary for the operation are, a common bistouri, a forceps, a curette, a spatula, strips of sticking plaster, compresses, and a roller.

The patient should lay in bed, on the affected side, with his leg extended, and placed upon a pillow. The surgeon should endeavour to bring the foreign body to the inner side of the joint, and as near as possible to the upper insertion of the capsular ligament. If the body should be most easily got at on the outer side of the joint, we might, after the example of Hewit, operate on that side.

Broomfield directs that the skin should be drawn up; Benjamin Bell advises that it should be drawn up; and Desault, that it should be drawn to one side, before the patella. Others have operated with success without making the opening oblique. We think the precaution of making a valvular opening a useful one, though it is not, perhaps, so important as has been imagined.

One assistant should draw the skin inward; the surgeon, holding the foreign body between the thumb and fingers of the left hand, makes, at one stroke, an incision through the skin and capsule, large enough for the easy passage of the tubercle. If the first incision should not be sufficiently extensive, it would be better to enlarge it than to bruise and lacerate the sides of the wound by crowding the foreign body through it.

Perhaps the foreign body will escape of itself; if it do not, we may extract it by means of the curette or spatula; carefully avoiding to injure the capsule, or the cartilages of the joint. When there is any ligamentous connexion of the body we should divide it. It is better, in the event of there being two foreign bodies in the joint, not easily removable through one opening, to defer making a second until the first has united.

As soon as the body is extracted, the assistant should leave the skin to close over the incision through the capsule; the lips of the wound are then to be kept in contact with adhesive plaster, upon which we should apply some compresses wet with a vegeto-mineral water, and over them a bandage.

After the operation, the limb should be kept at rest, and extended, for eight or ten days; at the end of which time the wound will generally be found to have completely united. It will be prudent for the patient not to walk for fifteen or twenty days.

The operation is rarely painful. Hemorrhage need not be feared, for, should any occur, compression would arrest it. Imprudence on the part of the patient is most to be apprehended: to this cause, or to the neglect of due preparation for the operation, want of success is generally attributable. The patient of Simson, whose case we have spoken of, experienced excruciating pain in the knee, which was prodigiously swollen. It is remarkable, that he complained of the greatest pain on the side opposite to that on which the incision was made. He could not suffer his leg to be moved, in the slightest degree, without screaming with agony. Narcotics gave him all the little sleep he could enjoy; bleeding, purgatives, and poultices afforded slight relief. Water injected into the joint was most beneficial: two men were alternately employed, one hour at a time, to inject it with a common clyster syringe. Although this diminished the pain and swelling, neither were removed completely until an issue was formed on the outer side of the knee. By means of this, and injections continued for the space of twelve months, the patient was perfectly cured.

Reimarus says he saw Mr. Hewit extract a cartilaginous body from the right knee of a young man, aged twenty-three years. The incision was made near the external and superior part of the patella. The patient complained of a pretty sharp pain during the operation: but the remainder of the day he was easy; he was bled. On the day following he complained of acute pains in the knee and foot; another bleeding was prescribed without relief. The man

was feverish and restless; the knee swelled. On the next day, the lips of the wound were drawn asunder, and an opaque serous fluid escaped; some relief followed; another bleeding was prescribed, and poultices and fomentations were applied for four weeks; during which the pain continued very acute, especially on that side of the limb which was opposite to the place of the incision. After some time the pains gradually diminished under the use of Peruvian bark, and the patient left the hospital with the knee somewhat stiff and swollen.

Mr. Ford operated upon a young man, who did well until the seventh day: at this period the patient became feverish, and his knee painful. Symptoms of the measles soon appeared, and the cure was retarded; but by bleeding and low diet, the patient was made well in a month.

Desault extracted a foreign body from the knee of a patient, aged forty-five or fifty years. The patient had been subject to vague rheumatic pains: the wound healed kindly; but, on the fifth day, the middle of the thigh became swollen, and an abscess formed there, which required two months to heal.

From these facts we infer, that all the bad consequences which occasionally follow the opening of the knee-joint for the extraction of foreign bodies formed within it, arise from the imprudence of the patient, from some latent disease, or from disorder of the first passages.

All these sources of danger we think the surgeon can remove, and, though some danger is inevitable, the risk of the operation is not such as should lead us to abandon it, much less resort to amputation, as is advised by Bell, in preference to opening the joint.

CHAPTER XLI.

Of Dropsy of the Joints.

IN the healthy state, the joints are lubricated by a viscid, albuminous fluid, called synovia. When this fluid is accumulated so as to distend the capsule, it constitutes hydarthrus, or articular dropsy; a disease not common—sometimes very serious, and always difficult to cure. It may affect any of the joints, but it most often attacks the knee. The hip-joint is, perhaps, the only one in which it has not been observed.

The quantity of synovia which may be collected in a joint, is generally proportioned to the extent of the capsular ligament: but the same joint contains very different quantities in different instances. As much as sixteen or twenty ounces have been found in the knee-joint; but the quantity is seldom so great.

Synovia, accumulated in a joint, undergoes changes similar to those of all other secreted liquors that are retained in cavities formed to receive them; it becomes thick, more viscid, and of a fawn colour. Independently of these changes, which arise simply from a retention of the synovia, the various morbid states of the synovial membrane may render it turbid, thick, greyish, like whey, or give it a greater or less quantity of grounds, or albuminous flocculi.

The progress of this disease is almost always slow; but in some cases it is acute. It may be simple, or it may be connected with a diseased state of the joint.

It is always local or idiopathic. It arises from a destruction of the equilibrium of the exhalations of the synovia and its absorption. It is said, that when the exhalation is increased, the disease is acute, and when the absorption is deficient, the disease is chronic.

The remote causes of this disease are external and internal. Among the first we enumerate contusion, distortion of a joint, extreme cold, an ancient and neglected cold, the presence of a moveable foreign body in the knee, and, in general, whatever can mechanically irritate the articular capsule, and produce a chronic latent inflammation of that membrane. The internal causes are, a metastasis of erysipelas, or any other disease, but the most frequent are rheumatic affections. Rheumatism has a predilection for the knee, and it often causes an effusion of synovia into the

joint, which, if not absorbed, constitutes hydarthrus. In acute rheumatism, the collection is formed suddenly; in chronic rheumatism, slowly and insensibly: in the former case, the dropsy is rarely considerable, and often disappears spontaneously; in the latter, it is very difficult, and always requires much time to effect its absorption.

The exhalation produced by rheumatism is frequently seated in the cellular tissue which unites the inferior and anterior part of the femur with the triceps cruris muscle, and a tumour is formed, which resembles dropsy of the joint, so strongly, that it is often difficult to distinguish the two affections from each other.

Hydarthrus appears under the form of a soft tumour, circumscribed by the insertions of the capsular ligament; without change of the colour of the skin; indolent, or causing very little pain, or impediment to the motion of the joint; yielding to the pressure of the finger, but not retaining its impression like edema. The tumour is most apparent at those parts where the capsular ligament is loosest and most thinly covered. At the wrist, it occupies the anterior and posterior part of the joint, but especially the former, while, at the sides, it is scarcely perceptible. At the anklejoint, the tumour is more apparent, before the malleoli than at any other part. At the shoulder, it is scarcely perceptible, except in the interval between the deltoid muscle and the pectoralis major. The knee, which is the most frequent seat of articular dropsy, becomes swollen at its sides and in front, but not at the posterior part: the swelling is confined, in the first instance, by the insertions of the capsular ligament; but afterward this yields, and the tumefaction extends upward between the femur and the triceps cruralis, which it raises. I have seen the tumour extend two thirds of the distance up the thigh. It is divided longitudinally by the patella; its ligament, and the extensor muscles of the leg, which are less prominent than the capsular ligament on each side, especially on the internal side; the leg is capable of flexion and extension, nearly as well as in perfect health; and the tumour is harder when the leg is bent than when it is extended.

To perceive the fluctuation, which is one of the best characteristics of this disease, we should place the ends of two or three fingers of one hand upon one side of the tumour, and strike upon the opposite side with the end of the middle finger of the other hand. The fluctuation is, in general, very distinct. The patella being removed from the articular pulley, if it be pressed backward, we perceive that it

passes through a certain space before it strikes against the bones, and again is separated from them when the pressure is taken off.

These symptoms sufficiently distinguish dropsy of the joint from white swelling, from encysted tumours, that sometimes form behind the triceps cruralis, from rheumatism, &c.

It is very difficult to cause the absorption of synovia from a dropsical joint, and we are often obliged to leave the disease to itself, or have recourse to an uncertain and dangerous operation. The most favourable cases are those in which the disease is occasioned by rheumatism translated to the joint. In such instances, the collection is often absorbed in a short time ; but the disease is very apt to return. The worst result that can happen is the termination of the dropsy in white swelling.

The indications in the treatment of articular dropsy are, first, to remove the inflammation of the ligaments, and, afterwards, to obviate the debility of the lymphatic vessels which succeeds to it.

When the rheumatic affection of a joint is moderate, and the pain is not acute, low diet, rest, the warmth of the bed, fomentations, and cataplasms, emollients and anodynes are generally sufficient to remove the inflammation ; but, in more severe cases, local, or even general bleeding, and a strict antiphlogistic regimen are required. As soon as the inflammatory symptoms have abated, nothing will be more useful than to attract to the integuments the morbid principle which is fixed in the joint, by the successive applications of several weak blisters around the joint. Thus not only a copious discharge of serum is kept up, but a constant irritation, which, in deep-seated inflammations, and those of serous membranes, is much more useful than the discharge itself. Stoll and other celebrated physicians employ blisters in rheumatic affections, when the inflammation is at its acme.

As this disease is almost always purely local, and independent of the general causes of dropsy, topical remedies chiefly are useful : diuretics, sudorifics, &c. are of little or no service.

The external applications which have been employed with most advantage, are spirituous aromatic fomentations—resolvent fumigations—volatile liniment, or liniments made with the balm of Florence, and the tincture of cantharides—bags filled with the powders of aromatic plants, slacked lime, and the muriate of ammonia—long-continued and re-

peated friction with flannel impregnated with an aromatic
vapour—the application of paper dipped in hot strong vine-
gar, and frequently renewed—pumpings of warm water,
with or without the muriate of soda, or sulphuret of potash—
a bandage moderately tight. These different means, varied
and combined according to circumstances, frequently suc-
ceed: but the successive application of blisters is probably
more powerful, both in preventing and curing the disease.
Some practitioners employ mustard, and other rubefacients.

We should avoid producing ulcerations of the skin. They
are sometimes difficult to heal, and prevent us from continu-
ing the irritating applications.

We have often employed blisters with success, but never
with success so marked as in the following case: A man,
aged forty-two years, exposed, by his profession, to the incle-
mencies of the weather, had experienced vague rheumatic
pains for eighteen months previous to the 23d of July, 1812,
when he entered the Charité. The right knee had then been
dropsical for three weeks, and the left for eight days. I ap-
plied successively five blisters upon each knee. On the 1st
of October, the patient left the hospital entirely cured.

Moxa is employed if blisters do not succeed. Several cy-
linders of cotton are burnt on one side of the knee: they
ought not to be suffered to produce a deep ulceration. It
would be useless to try this remedy if the bones had become
carious.

There is yet another resource, when these means fail—
the evacuation of the synovia. This operation is not always
successful, and sometimes produces fatal constitutional irri-
tation, or leads to the necessity of amputating the limb.

It is evident that the discharge of synovia does not restore
the equilibrium between the exhalation and absorption of
this liquid. The operation cannot, therefore, cure the dis-
ease in any other way than by exciting an inflammation of
the synovial membrane, which shall cause it to adhere to
the parts with which it is in contact; and such inflammation
is always dangerous. Were the capsule perfectly healthy,
and did the disease depend entirely upon the debility of the
absorbents, a slight degree of inflammation, excited by a
suitable injection, might, perhaps, effect a cure, by ob-
literating, in some degree, the cavity of the joint; but the
synovial membrane is almost always thickened by the pre-
ceding inflammation, and an opening commonly causes it to
suppurate; in which case, if the pus be small in quantity,
and can be discharged frequently, by a moderate opening,
the patient may be cured, with more or less stiffness of the

joint : under more unfavourable circumstances, he will pro-
bably lose his life or his limb.

In what cases are we justified in evacuating the synovia
by an operation ? 1st. When dropsy of the joint is compli-
cated with the presence of a foreign body, formed within it.
The cases we have cited from Simson and Paré establish
this rule.   2d. When the disease is acutely painful, and pre-
vents the limb from being moved ; for, if under such cir-
cumstances, the operation be not performed, the bones be-
come carious, and the patient incurs greater risk of losing
his life than he would by suffering the fluid to be discharged.

The capsule may be opened with a trocar or bistouri.
The synovia is very rarely so thick as not to escape freely
through the canula of a trocar; but the opening closes
very soon, and the ulterior accumulation of synovia is not
prevented.

An incision is necessary in most cases.   It should be made
on one side of the joint, and in the most prominent and de-
pending part, and the skin should be stretched, in order to
make the opening valvular ; the wound should not be closed,
but should be covered by a dossil of lint, with cerate spread
upon it ; compresses, wet with a resolvent liquor, should
then be applied.

At the end of twenty-four hours, we sometimes find the
joint as large as it was before the operation, the lips of the
wound having become agglutinated ; we should separate
them, and introduce a small pledget of lint, or a strip of
linen.   After the operation, the patient should be bled, and
put upon a strict antiphlogistic regimen, &c.

When we are obliged to make several openings, a seton
may be useful.

Case I. A young man of weak constitution fell upon the
right knee, at the beginning of his convalescence from a
chronic disease.   The pain was so acute that he could not
rise.   Some hours after the fall, the knee became swollen,
tense, red, and painful.   Fever ensued, and the part was
poulticed for seven days : the capsule of the joint became
filled with a fluid, the fluctuation of which was evident.   On
the twenty-fifth day an incision was made through the side of
the joint : ten ounces of serous fluid, like that of dropsies
of other parts, escaped : the part was kept wet with resol-
vent liquids.   Twenty-four hours after the operation, the pain
increased, and the swelling was as great as before ; the
incision was enlarged ; more fluid escaped ; and a pledget of
lint was introduced between the lips of the wound.   In a few
days another tumour formed on the internal side of the

knee : it was opened ; one or two ounces of a puriform fluid escaped through the divided capsule ; injections of rice water and honey were thrown into the joint ; the symptoms moderated, and the patient was cured in the space of two or three months. At first it was very painful for him to bend his knee, which afterwards became more flexible, but never so much so as the other.*

Case II. A man, aged twenty-four, had a dropsy of the knee, of four weeks standing, without any known cause. Warner made a lateral incision through the skin and capsule, which gave issue to fourteen ounces of a thick gelatinous fluid, tinged with blood. After some days it became necessary to enlarge the opening, which had become too small. Afterwards an abscess formed on the opposite side, which was opened. The patient was cured in the space of three months.†

Case III. Schlichting was consulted by a Rabbi who had had a dropsy of the knee for eight years, and which had been treated without success in London, Paris, and different parts of Germany. He made a large incision by the side of the patella; a great quantity of a limpid fluid, that coagulated by heat, was discharged, and four glandular substances, of the size of nutmegs, were extracted. As the incision was large, the surgeons present ascertained by the sight and touch, that the bones of the joint were healthy. The capsular ligament had been ruptured long before, in consequence of the distention by the fluid within it. The interstices of the muscles, and the cellular tissue, were so infiltrated, that a probe could be passed to a great distance between them. After having ascertained the relations of the sinuosities, suitable incisions were made : a gelatinous fluid was constantly discharged through them.

The patient was feverish on the day following the operation. Soon afterwards, a fleshy excrescence arose from the bottom of the wound, and separated its lips, causing much pain, and preventing the easy discharge of the fluid in the joint. Escarotics did not check its growth; the ligature was employed; the fungus shrunk, as if it had been burnt. At length, after the use of injections composed of myrrh and the spirits of turpentine, it became detached, and the wound was then closed with sticking plaster, for which a tight roller was afterward substituted, and kept on six days ; at the end of this time, the wound was entirely healed.

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* Lassus Pathol. Chirurg. t. I. p. 313.
† Philosophical Transactions, for the year 1755, vol. xlix. p. 452.

In two months the patient could move the limb and support himself upon it.*

Case IV. A negro woman, aged thirty-six years, of a bilious and robust temperament, came to the hospital of the Cape, in April, 1789, with the right knee swollen and painful. Mr. Gay prescribed a poultice made with the clay used by cutler's and vinegar, and had the patient purged: she then left the hospital to resume her ordinary occupations.

Some time afterwards she returned. The pain and swelling had considerably increased; it was evident that an effusion had taken place into the cavity of the joint; a trocar was immediately plunged in; a transparent liquid escaped; injections of Goulard's water, rendered more active by the addition of camphorated spirits, were thrown into the joint to wash away any of the fluid which might remain. The whole quantity evacuated was estimated at seven or eight ounces.

On the fifth day the swelling had entirely ceased; only a slight oozing through the puncture continued. The patient left the hospital, cured, twenty days after the operation.†

In the following cases, the consequences resulting from opening the knee-joint were not so fortunate.

Case V. A patient had dropsy of the knee. A lancet was plunged through the internal side of the tumour; nearly a pound of fluid was discharged; the wound was covered with lint and a small plaster; the knee was enveloped in aromatics and stimulants; the patient took purgatives and hydragogues. Notwithstanding these precautions, the collection began to return in a few weeks. Another surgeon made a large incision into the joint, in the internal side of the knee; violent pain, fever, inflammation, and copious suppuration followed. Amputation became necessary to save the patient's life.‡

Case VI. Francis Jerome ——, aged forty-four years, entered the Charité on the 24th of August, 1812, with dropsy of the left knee, of fifteen months duration: the swelling was soft and fluctuating; it extended one third of the distance up the thigh; the skin was not red, nor were the motions of the knee limited or painful.

No cause could be assigned for this disease. Many insignificant remedies had been tried, and at length blisters were applied; but they produced no favourable change.

* Act. Phys. Medic. Nat. cur t. viii. p. 69.
† Recueil Périodique de la Société de Médicine, année 1767.
‡ Essay upon Dropsy, by Monro the younger, p. 244.

Before I ventured to open the tumour, I used blisters and various applications without success. It continued to increase, and I resolved to puncture it.

On the 27th of September, a trocar, of the ordinary size, was plunged into the inferior and external part of the tumour, in a direction obliquely upward and inward: six ounces of a yellow viscid fluid were discharged through the canula; the wound was covered with diacholon plaster, and a roller was applied tightly to the knee.

On the 28th of October the tumour was as large as before the operation: a second puncture was made, and seventeen ounces of fluid, similar to the first, were evacuated. A few days afterwards, a new collection had began to form, and the patient left the hospital to put himself under the care of a quack, who promised to cure him. The charlatan made a third puncture into the joint, in the same place where the last had been made, and left the canula in the wound. The knee soon became very much swollen; violent fever, and excruciating pain ensued; the canula was withdrawn after a few days, and a gum elastic bougie was introduced into the opening, which it exactly closed; emollient poultices were applied with some advantage. When the bougie was withdrawn, a great quantity of black sanious matter was discharged; the patient used daily a bottle of a sudorific tisan, and, while sinking under copious sweats, hectic fever, and diarrhœa, he still regretted that the exhaustion of his money deprived him of the further services of the charlatan, and obliged him to return to the hospital.

On the 7th of December he was brought back: I found the tibia capable of being moved transversely upon the femur, with a grating noise; a sanious fluid flowed in a stream from the opening when the patient bent the leg, and compressed the tumour with his hands; the limb was placed in an apparatus for fractures; injections of rice water and honey were thrown into the joint; Peruvian bark was prescribed.

But, in a short time the hectic symptoms, which had disappeared, returned with increased violence; the lower extremities became anasarcous, and the patient died on the 9th of January, 1813.

Dissection. The cavity of the tumour, which contained a fetid sanies, was divided into two parts; the upper and larger of which, formed by the distended capsular ligament, extended one third of the distance up the thigh: it communicated with an abscess, situated between the gastrocnemii and solœii muscles, and reached half way down the leg.

The second cavity was situated behind the triceps cruralis muscle, and extended to the crural arch. The surface of these cavities was black; the cartilages were absorbed; the tibia, femur, and patella were carious; the crucial and lateral ligaments were destroyed.

Facts of this kind are rare; but many undoubtedly would be on record if the cases which terminate in death were published with the same zeal as those that are successfully treated.

CHAPTER XLII.

Of White Swelling.

WHEN a disease presents many varieties in its progress, symptoms, causes, and consequences, it is difficult to give it a name that conveys an accurate idea of it, or that is applicable to every case: such is the disease of which we are to treat in this chapter.

Different names have been assigned to it, derived from one or more of its symptoms: it has been called white swelling, because the skin generally preserves its natural colour, and presents no mark of inflammation—fungous tumour of a joint, on account of its stiffness and elasticity—lymphatic tumour or serous congestion of an articulation, because the lymph is effused and thickened in the cellular tissue surrounding the ligaments—false anchylosis, because the disease produces more or less difficulty of motion—and, lastly, rheumatic or scrofulous swelling, indicating its causes.

White swelling is generally defined to be a chronic congestion of a joint, circumscribed, without change in the colour of the skin; sometimes hard, and resisting the pressure of the finger; sometimes soft and elastic; sometimes so soft as to give an idea of fluctuation which does not exist; sometimes indolent, but commonly very painful during the motion of the articulation, which is rendered difficult or impossible. These congestions are seated in the ligaments and the cellular and fatty parts, called synovial glands, and even in bones and cartilages. This definition is only a simple enumeration of the symptoms of white swelling, and is far from conveying an exact idea of its numerous and varied appearances, which are hardly alike in any two cases.

Any joint may be affected with this disease, but the gin-glymoid joints are most obnoxious to it; we are, however, to except the joint of the femur with the os innominatum, where it is very common, and known under the name of consecutive luxation of the thigh, because it is almost al-ways attended with displacement of that bone. Of the gin-glymoid joints, the knee is most often affected; next to this the elbow, foot, and hand: the small joints are rarely the seat of the complaint.

White swelling may appear at any age; but infancy and youth are most subject to it. It occurs most frequently in winter and autumn, especially if the weather be damp.

The disease sometimes commences with pain in the joint, which extends along the aponeuroses and tendons of the neighbouring muscles. Sometimes this pain is dull and su-perficial, seated in the soft parts, and extending over the whole joint; sometimes it is acute, deep, and confined to one spot, which is commonly the centre of the articula-tion. In some instances, the swelling succeeds a pain in some other part of the body, and which had suddenly ceased; or to an eruptive disease, such as the small-pox, measles, &c. White swelling, depending upon an internal cause, often commences during the night; the patient awakes, and finds his knee painful and swollen.

In whatever manner the disease may commence, it al-ways appears in the form of a tumour, which presents the following characteristics.

It rarely surrounds the whole articulation, but is almost always confined to a part of its circumference. In the knee it commences above the patella, and below this bone on the lateral parts of the joint, especially the internal side; in the foot, it appears below and behind the malleoli; in the fingers, it generally occupies the whole articulation. The tumour is circumscribed, immoveable, more or less hard, and elastic: not retaining the impression of the finger like edema, but conveying generally a sensation of softness, that gives an idea of fluctuation which does not really exist. It is more or less painful, particularly on pressure: sometimes, how-ever, it is indolent: the skin preserves its natural colour; motion of the joint is painful and difficult. In some cases, the leg remains extended, but more commonly it is bent to a considerable degree, and extension causes great pain. In white swellings of the elbow, the forearm is always flexed; in those of the wrist, there is a marked tendency to flexion, and to prevent incomplete luxation of the carpus backward, we are sometimes obliged to support the hand with a splint.

Constant flexion produces a contraction of the flexor mus-
cles and their tendons, which creates a hard ridge along the
course of them. The total want of motion, which results
from the stiffness of the muscles, soon renders the joint im-
moveable; frequently it is more or less anchylosed.

The disease may remain a long time in the state we have
described, cease to be painful, and cause only a great weak-
ness in the knee, producing more or less limping. But
more frequently it continues progressing without inter-
ruption; or if its progress has been suspended, and the com-
plaint has remained stationary for a long time, it pursues its
course again after a fall, a blow, or without any apparent
cause. The articulation becomes more swollen, and, if it be
the knee, the hollow of the ham is tumefied and filled up;
the pain increases, and is felt sometimes in one part of the
articulation, sometimes in another; sometimes between the
ham-strings, sometimes in the interior of the joint; it in-
creases towards evening, and at every change in the wea-
ther; motion especially aggravates it: yet there are some
patients, however, who suffer little or not at all. The hard-
ness of the tumour varies greatly as the disease progresses.
But some white swellings are hard from the beginning, and
some remain soft for a great length of time. This de-
pends greatly upon the seat of the disease, which sometimes
is in the bones, sometimes in the ligaments and surround-
ing cellular tissue. The skin over the tumour becomes
pale, shining, and thin; the subsultaneous veins dilate
and become varicose; the muscles of the leg become thin
and wasted; so that its bulk is greatly diminished; but
occasionally it is increased by the infiltration of the cellular
tissue; the lower part of the thigh undergoes a remarkable
diminution; the lymphatic glands of the groin become en-
larged and tumefied. When the disease has made great
progress, the bones are softened, and the articular cartilages
destroyed; lastly, abscesses form in the different parts of
the tumour, which are attended with great pain and high fe-
ver. These abscesses are situated more or less deeply, and
frequently communicate with the joint. When they open of
themselves, or when they are opened by the surgeon, a large
quantity of matter is discharged, which rarely possesses the
qualities of healthy pus. It is generally a yellowish sero-
purulent fluid, like whey, with some flocculi of albumen
swimming on it. Sometimes, however, it is as consistent as
pus; but it soon changes to a thin, ill-conditioned sanies.
Its discharge does not, in the least, diminish the swelling.
The openings, which are made to evacuate this liquid, some-

times heal quickly, and new abscesses form in different parts, which open and heal like the former. But generally these openings form articular fistulæ.

In the beginning, the disease does not at all affect the system, and it is only after a certain time that the general health becomes injured. This is produced, in part, by the violence of the pain, which prevents the patient from sleeping and eating, and partly by the absorption of the matter of the abscess. The effects of this absorption are scarcely perceptible before the abscess is opened; but after it bursts, or is cut into, the contact of air deteriorates the pus, and causes it to be fetid. Slow fever then supervenes, with nocturnal sweats and colliquative diarrhœa, which reduce the patient, and prove fatal, unless checked by amputation.

Dissection of the knee shows, that at first the seat of the disease is in the soft parts alone, and that the bones and cartilages become subsequently affected; while others are seated in the bone, the ends of which are softened and swollen, and the disease extends to the ligaments and other soft parts about the joint only in an advanced state of the disease.*

In that kind of white swelling which is seated principally outside of the joint, if we examine the knee before suppuration has destroyed its situation, we find the ligaments which strengthen the articulation, the capsule itself, the cellular tissue about the joint, and especially that behind the ligament of the patella, that which connects the femur with the lower part of the triceps femoris, as well as that which fills the space between the condyles of the femur, behind the crucial ligaments, infiltrated, and filled with a fluid, more or less thick, and converted into a soft, spongy, fungous, hemogeneous mass. The skin and subcutaneous cellular tissue do not participate in the morbid changes of structure, except that the fat of the latter is rather more yellow and consistent than natural; sometimes, however, the cellular tissue is filled with glairy matter. In some cases, the cellular tissue between the ligaments is so thick and dense that it is hardly distinguishable from the ligaments themselves; so that . every thing about the joint appears cartilaginous, or like inter-vertebral substance. Thus the fatty substance behind the ligament of the patella becomes so condensed and thickened as to form one undistinguishable mass. The periosteum, which covers the ends of the bones of the diseased articulation, is usually thicker and more dense than natural. The large nerves which pass by the joint are more enlarged and

* See note J.

more dense than natural. In the greasy fungous mass into
which the cellular substance and ligaments are converted,
are found purulent collections, passing in different directions
through this diseased part. The muscles around the arti-
culation, and the cellular tissue between them are filled with
glairy matter. Nevertheless, in the midst of the disorder,
the flexor muscles, though retracted, preserve their natural
colour and consistence.

In the early stages of the disease we perceive no change
within the joint: the synovia is healthy, but somewhat more
abundant than natural—sometimes so much so as to raise the
patella, and lead to the suspicion of dropsy of the joint.
The consistence and colour of the semilunar cartilages, and
those which cover the ends of the bones, are not changed;
the bones themselves appear natural, but after a short time
they are more or less swollen; their spongy tissue is yellow,
softened, and may be easily penetrated with the edge of a
scalpel. At a later period we find more or less sanious
matter within the joint; the semilunar cartilages, and those
which cover the ends of the bones, are softened, and con-
verted into a glairy substance, sometimes red, and destroyed
wholly or in part; the substance of the bones is carious, and
destroyed to a greater or less extent. What is worthy of
remark is, that in the centre of this disorganization, we
sometimes find portions of bone of the hardness and colour
of ivory.

In that kind of white swelling which is seated principally
in the bones, at whatever period of the disease we dissect
the joint, we constantly find the articular extremities, and
particularly the condyles of the femur, enlarged, and their
spongy tissue yellowish, softened, and easily cut or pierced.
In the beginning of the malady, the soft parts are little af-
fected; but, in the advanced periods of the disease, the liga-
ments, the cellular tissue which surrounds them, and that
which passes between their fibres, and the fatty cellular sub-
stance, which has been considered as synovial glands, are in-
filtrated with viscous glairy matter, and are converted into a
fungous lardy substance; the bones swell and become soft;
they are affected with caries; their spongy structure is dis-
solved and reduced to a fetid sanious matter. This sometimes
happens even before the cartilages are diseased, but after
some time, these become affected and absorbed.

Such are the organic alterations commonly produced by
white swelling. They are extremely diversified; but it is
sufficient to have noticed the principal, and to observe that
the disease is scarcely the same in any two patients.

The causes of white swelling are external and internal.
Among the former have been enumerated physical injuries
of the joint—such as wounds, contusion, distension, a forced
march in cold, rainy weather, living in a damp situation,
&c. But this disease is rarely produced by an external
cause alone, and when its appearance has been preceded by
external violence, this is to be regarded merely as the ex-
citing cause ; the real cause being internal. Among the in-
ternal causes are placed rheumatism, scrofula, scurvy, and
syphilis ; the morbific matter of fever, of small-pox, of
measles, &c. carried to the joint by metastasis ; suppression
of the menses, of an habitual hemorrhage, of the itch, &c.
But rheumatism and scrofula probably produce three out of
four cases of the disease : the former causes it most gene-
rally in youth, and adult age, where there exists strength
and plethora : scrofula produces it most commonly in child-
hood.   Rheumatism has a predilection for large joints,
especially for the ligaments and adjacent cellular tissue,
which it thickens and hardens, by causing an exudation of
glairy matter.   Hence it is observed, that these parts alone
are affected in the commencement of white swelling caused
by rheumatism.

As for scrofula, it attacks, especially in infancy, the ex-
tremities of the bones, in which it produces swelling, accom-
panied, at first, with softening of the spongy substance, and
subsequently caries and absorption. Thus scrofula com-
mences in the bones, and affects the soft parts secondarily—
but rheumatism attacks the soft parts first, and the bones
afterwards.

It is easy to distinguish white swelling from the other af-
fections to which the joints are subject ; but we cannot al-
ways determine precisely the species of this disease, which
is, nevertheless, very important in the prognosis and treat-
ment.   It is possible, to a certain extent, when we are wit-
ness of the first onset of the malady : but it too often hap-
pens that we are not consulted until it has made some pro-
gress, and then, if the patients cannot give an exact de-
scription of their symptoms, we cannot determine the spe-
cies of the disease, because, from whatever cause it arises,
it is alike in its latter stages.

There is reason to suppose the tumour to be rheumatic, if
the patient be a young man, or an adult of full and plethoric
habit, who has previously had the rheumatism ; if the dis-
ease appear during the autumn or winter, in damp, cold
weather; if it commence with a violent pain in all the joint,
which extends to the surrounding muscles ; if this violent

pain be quickly followed by a swelling of the soft parts that surround the joint, which presents a circumscribed tumour, elastic, more or less painful, without augmentation of heat, or change of colour in the skin, &c. and if, in the commencement of the disease, this tumour is only an enlargement of the soft parts, the bones not being affected, but becoming so in a more advanced stage of the complaint.

We should not confound white swelling produced by rheumatism with rheumatic affections of the joints, commonly called gouty. Although these maladies are of the same species, they differ from each other in their symptoms, progress, and termination. Gouty rheumatism affects several joints at the same time: it attacks both the small, the middle sized, and the large joints; most commonly all the articulations of one side of the body are affected at once. But what especially characterizes rheumatism, is the facility with which it moves from one part to another: it sometimes changes from one side of the body to another in twenty-four hours. These changes often take place for several days together. White swelling, on the contrary, is always stationary. Moreover, in gouty rheumatism, the colour of the skin around the joint frequently is changed, and the heat of the part affected is more rapidly or sensibly increased than in white swelling. Although in gouty rheumatism the pain is more violent than in white swelling, the limb is never in a state of constant and permanent flexion; the enlargement of the joint, which often continues in that disease after the fever has ceased, is still more easily distinguished from white swelling, by its want of elasticy, by the edema, by the absence of pain, by the little rigidity of the flexor muscles, and the facility with which this rigidity is dissipated.

We have before observed, that a white swelling is considered as scrofulous when it commences in the bones of a joint. We may be certain of this fact if the patient be an infant or a youth—if the previous pain have been very acute, and confined to a circumscribed spot, which is generally the centre of the articulation—if the enlargement of the joint, whether slow or sudden, depend upon the swelling of the lower part of the femur, and very little upon the congestion of the soft parts; and, finally, if the patient be born of scrofulous parents, or if there be or have been, in the former part of his parents' life, symptoms which indicate scrofula. It is, however, to be observed, that white swellings, produced by scrofula, often appear when no previous indication of the disease has existed, and even in infants of apparently sound constitutions.

As to white swelling produced by other causes than rheumatism and scrofula, their symptoms do not greatly vary from those we have mentioned. Thus, when white swelling follows the repelling of an herpatic affection, or of the itch, in a person of good constitution, who has never been affected with rheumatism or scrofula, we cannot mistake its cause. The same may be said of white swelling which supervenes to suppression of the menses, or an habitual hemorrhage—of that which appears in the course or towards the decline of any fever, of small-pox, of measles, &c.

The prognosis of white swelling is generally very serious; but more or less so according to the cause of the disease, its duration, its symptoms, the constitution of the patient, &c. White swellings caused by rheumatism, are generally least serious, especially if recent; we may then often arrest the progress of the disease, and even cure it entirely. In this case, the joint sometimes returns to its natural state, and freely performs all its motions; sometimes it retains a stiffness, which deprives it, in part or altogether, of this power. White swellings which depend altogether upon an external cause, in patients otherwise healthy, may be entirely cured. The worst cases are those produced by scrofula: they are seldom cured, and when they are, the joint almost always becomes anchylosed.

From whatever cause a white swelling arise, if it be of long standing, attended with severe pain—if the bones and cartilages be swollen, softened, and carious, and the articulation filled with sanious matter—if fistulous openings have formed, through which is discharged sanious fetid pus, the disease is generally incurable. In this case, the violence of the pain, the slow fever, copious sweats, and colliquative diarrhœa bring on marasmus and death, if we do not hasten to amputate the limb. In some of these cases, however, nature, assisted by art, triumphs over the disease. Then the suppuration gradually diminishes, and the pus becomes of better quality; the slow fever, copious sweats, and wasting diarrhœa diminish, the appetite returns, the digestion improves, the patient grows stronger, and gets off with an anchylosis. But these are rare cases: they do not justify us in delaying amputation.

White swellings are generally most dangerous in feeble and cachectic persons. Infants bear the disease better than youths and adults.

Among the infinite variety of remedies that have been proposed for the cure of white swelling, we have the mortification to find ourselves often unable even to palliate the disease.

Perfect rest at the limb is the first essential point in the treatment. Motion uniformly causes irritation and pain.

White swellings caused by rheumatism being always, in the first instance, inflammatory, we should have recourse to early bleeding, both general and local.

When this has been carried to sufficient extent, blisters are to be applied: first a small one is to be placed on the anterior part of the joint; then another on one side, and, before this is healed, a third on the opposite side. This mode of blistering is much more efficacious than the successive application of large epispastics over the whole joint. The part, at the same time, should be wrapped in flannel. The diet must be suited to the phlogistic diathesis of the patient. These means generally dissipate the pain and inflammation: if they do not, we should have recourse to opiate and camphorated liniments, or a strong decoction of poppy heads, or of the leaves of nightshade, or henbane. But these remedies ought not to be used unless the pains be extremely severe, lest they fix the disease in the joint.

When the inflammatory state has ceased, we should substitute, for the foregoing remedies, frictions with dry flannel, impregnated with the vapour of succinum, volatile camphorated liniments, a plaster of styrax, sprinkled over with flowers of sulphur, poultices made with the root of rasped briony boiled in milk, black soap softened with camphorated spirits, bags filled with a mixture of powdered lime, tan, and the muriate of ammonia. Bell speaks very highly of mercurial frictions thrice a day, for one hour each time, and in such quantities only as to avoid salivation. I have often employed mercurial frictions in this way, and with success. I attribute the benefit more to the friction than to the action of the mercury.

Rheumatic white swellings are often cured by the above named means; but sometimes a degree of stiffness remains in the limb, which renders motion painful or impracticable. This stiffness depends chiefly upon the retraction of the muscles, tendons, and ligaments, and is to be treated in the way we shall point out in speaking of anchylosis.

In white swelling produced by external violence, it is proper, in the first place, to moderate the inflammation by general and local bleeding, low diet, cooling and diluting drinks, and by fomentations and emollient poultices. Afterwards, when the pain and tension have abated, we should employ resolvents, and enjoin the most perfect rest, until there is no danger of a return of the symptoms from using the limb.

We should prescribe the same remedies in white swelling produced by suppression of the menses, or an habitual hemorrhage, by repelled itch, or other cutaneous affection, or by the metastasis of the morbific matter of any fever to the joint; and, in addition to them, if the disease be produced by a suppression of menstrual and other habitual discharge, we should either restore it, or replace it by bleeding. In cases of metastasis, of cutaneous affections, we must establish a drain near the seat of the disease.

The utmost diligence, employed even in the early stages of this complaint, does not always succeed in checking it; and when it is farther advanced, the chances of success are still smaller, and remedies more powerful than those we have mentioned, become necessary.

Le Dran and other practitioners recommended pumpings of warm water. To derive from them the utmost advantage, the water should be as warm as the patient can bear, and should descend from an height of seven or eight feet. The size of the column of water should be proportioned to the sensibility of the tumour; and when the pain is very acute, the end of the pipe should be closed by a metallic plate pierced in several places: but when the part is not very sensible, the pipe may vary in diameter from six to sixteen lines, and have but one opening. The pumping should continue near an hour, and when it is finished, the patient should be put in bed, and the joint covered with bladders filled with water as warm as can be borne. These should be renewed occasionally for the space of two hours: after which, the joint should be covered with warm linen, and left to sweat. At night the application of hot bladders should again be made, and the pumpings repeated every day, or every alternate day. This treatment is suited to all species of white swelling, and to all periods of the disease; but is particularly useful in cases in which the soft parts alone are affected, and in which the complaint is not far advanced. We may augur favourably of its effects, if, after each operation, the joint sweats and becomes softer.

A large pewter syringe, with a suitable tube adapted to it, may be substituted for more complicated apparatus.

The pumpings or injections may be rendered more active by the addition of the muriate of soda, the muriate of ammonia, of potash, or soda; or, what is preferable, by employing artificial or natural sulphurous water. By increasing the temperature of the water, or the force with which it impinges against the joint, we may add to the activity of this remedy, which has often effected surprising cures.

Our opinion of the utility of issues, perpetual blisters, and setons, which have been so much celebrated in the treatment of white swelling, is far less favourable to these remedies than that of most other surgeons, and after the bones and cartilages have become affected, we have found them evidently injurious.

Cauterization is the remedy of which the good effects are most conspicuous. It is most beneficial in rheumatic white swellings; but it does not suit the first or inflammatory state of the disease, nor the very advanced periods of it, in which the bones and cartilages have become carious; but in the intermediate stage it is highly serviceable. Farriers employ it with great success in the treatment of an analogous disease of horses.

Cauterization is also useful in white swelling produced by metastasis, suppression of any habitual discharge, &c. with the same restrictions as in rheumatic cases.

But in scrofulous cases, in which the cartilages and bones are the primitive seat of the disease, cauterization would be highly injurious.

The enthusiastic Pouteau, to whom is due the glory of having revived among us the practice of cauterization, applied it indiscriminately to all cases of this disease; but a very extensive experience of later surgeons has fully established the exceptions laid down in the last paragraph.

There are two methods of cauterizing diseased joints— with an hot iron, and with moxa. The ancients generally employed the first, but Hippocrates also recommends the latter in sciatica and gout.*

The irons employed by the ancients for the cauterization of joints were generally flat or olive shaped: they were applied to different parts of the articulation, and caused eschars, more or less deep, according to the heat of the instrument and the duration of its application. In some cases, however, they used the *cutellary* cautery, which they passed lightly over different parts of the tumour, so as to produce long, narrow, and superficial eschars. This method of cauterization, which alone is now in use, is termed by M. Percy *transcurrent.* We shall extract from his *Pyrotechnie Chirurgicale* the rules for its application.

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* Si verò in unum aliquem locum decubuerit dolor, et constiterit, neque medicamentis expelleter, urito quocumque loco dolor fortè consederit; sed eum lino crudo urito. * * * *

Quod si in pollicibus dolor relinquatur, venas in pollice paululùm supra articuli nodum incrité; ustio autem per linum crudem fiat. Libro de affect. sect. 2, cap. viii.

" While the instrument is heating, the parts to which it is
to be applied should be marked with ink, in order that the
operation may be conducted without hesitation. The number
of lines ought to be proportioned to the size of the articu-
lation and to the volume of the tumour. In general they
should be so far apart, that the inflammation which the fire
occasions during the first days may not extend entirely across
the interval between them.

" The iron should be heated to a very bright red heat, and
at first it ought to touch the skin only for a moment, that
the operation may be finished with one instrument. If we
have cauterized too slightly by the first application, we may
re-apply the iron, heated a second time, over the same parts,
taking care not to bear too hard nor unsteadily. The essen-
tial point is not to divide the integuments; for if they are
opened, a troublesome fungus is sure to be formed. For the
same reason should the cauterized lines not cross one ano-
ther.

" The marks left by the cautery are of the colour of gold,
and are so slight as to lead us to believe that a few days will
efface them: but when the eschar separates we are asto-
nished at its extent.

" Immediately after the operation, the parts should be co-
vered with dry flannel, or warm linen. When inflammation,
swelling, and pain come on, we must substitute soothing ap-
plications."

Although the ancients speak highly of the actual cautery,
in diseases of the joints, their works detail few cases of its
successful use. Fabricius ab Aqua pendente merely men-
tions that he cured a swollen and hardened knee by the appli-
cation of five or six cauteries. Even M. Percy, who prefers
the transcurrent cauterization, relates only three instances
in which it effected a cure. In one case, that had resisted
the use of moxa, he made upon the patella one longitudinal
eschar, four inches in length—one parallel to it of the same
length on each side of that bone, and a fourth, half as long
as the others, on the internal condyle. He also applied the
hot iron to a patient who had white swelling of the elbow.
The skin was burned in three converging lines, (like a goose's
foot, but not united at an angle); they were two inches in
length, and followed the course of the extensor muscles.
The patients scarcely complained of pain: one of them de-
clared that the operation was far less painful than the ap-
plication of moxa. The subject of the third case was a dra-
goon, aged thirty-six years, whose elbow had been stiff for
eighteen months: the ends of the two bones were swelled,

and the soft parts had a clayey feel. All imaginable reme-
dies had been tried without success. M. Percy traced with
a hot iron eight lines, each four inches long, viz. three on
the outer side of the joint, three on the inner, and two along-
side of the olecranon; the operation lasted only half a mi-
nute, and all were astonished to hear the patient say he felt
very little pain. There was a slight degree of inflammation
for a few days. The eschars successively came away between
the fifth and ninth days; the wound suppurated moderately,
and, by the time they were healed, the arm was flexible and
strong, and was reduced to half its former size.

Hippocrates recommends burning tow upon the skin in
obstinate siatica.

The Egyptians, Arabs, Japanese, and Chinese employ
combustible substances for cauterization, as we are in-
formed by Kœmfper, Prosper Alpinus, and other enlight-
ened travellers. The method of the Egyptians, the only
one which we have adopted, was naturalized among us by
Pouteau. The following is his process:

" Bind a piece of linen, one inch broad and three inches
long, around some raw cotton, as tight as possible. The
linen is to be secured by a few stitches: we then have a cylin-
der, an inch in diameter; cut it transversely half through
with a sharp knife: we shall then have two cylinders, with
a common base. It is this base which is to be laid on the
skin, previously moistened with saliva, so as to make it ad-
here. The lips of the cylinder being well fired, the cotton
is to be applied to the part we wish to cauterize. We
should then blow the fire with a bellows, a fan, or with the
mouth. The fire never extends beyond the skin, even when
two or three cylinders are successively applied to the same
spot."

In applying moxa to white swelling of the knee, if the
whole joint is painful, we should burn a cylinder of cotton
on each side of the patella. In the elbow, the lateral parts
of the joint should be selected; and in the ankle, we should
apply two cylinders behind and below the malleoli; in the
wrist, one upon the palmar and one upon the dorsal side of
the joint: but in every case where there is one spot more
painful than the rest, over that part the moxa should be ap-
plied. We augur favourably of the effect of this remedy if,
after several cauterizations, the pain and swelling diminish.

The efficacy of moxa is proved by the experience of Pou-
teau and other practitioners. In my own practice, several
rheumatic white swellings, after having resisted the usual
treatment, have yielded to two or more applications of this

powerful remedy: but where the bones have been swollen and painful, it has either afforded no relief, or only tempo-rary. In fact, I believe it can never be of permanent bene-fit, and that it may even do much injury in scrofulous affec-tions of the joint.

A remedy, in some respects analogous to cauterization, is the application of irritating substances to the skin. Fabri-cius ab Aqua pendente was consulted by a man of quality, whose knee was so swollen as to be incapable of the least movement: he judged the case incurable. An empiric per-suaded the gentleman to submit to the application of an ir-ritating plaster, which Fabricius believed to be made with a species of nightshade [Clematis flammula] which excited great inflammation. The knee soon became moveable, and the patient was finally cured. M. Percy has employed the remedy used by the Italian empiric: he does not state with what success. Undoubtedly it is capable of producing a very dangerous inflammation of the bones, yet I am inclined to believe it might be employed with advantage in some cases; for I have seen a white swelling of long standing, and very painful, greatly relieved by an erysipelatous inflammation. that took place around the joint.

Abscesses often form notwithstanding our best efforts to prevent them. They may be seated in the subcutaneous cel-lular tissue, or within the cavity of the joint. When the se-vere pain obliges us to open them, we should make a simple puncture with the bistouri. The introduction of a seton, which some practitioners recommend, is improper—even the opening made with a bistouri can seldom be healed.

The pain which occurs in white swelling, and when mat-ter is forming, requires the external and internal use of opium; but in many cases it is unabated by both.

Amputation of the limb is, in many cases, the only means of preventing the patient from sinking under hectic symp-toms. A judicious practitioner will weigh all the circum-stances of the case previous to his deciding whether he should amputate the leg, or keep the limb slightly flexed, and in a state of the most perfect rest, in the hope of curing the patient with a stiff joint.

Simple debility, provided it is not so great as to prevent a suitable degree of inflammation, is favourable to the success of amputation; but, on the contrary, the weakness which is connected with a vitiation of the fluids, and which is cha-racterized by colliquative diarrhœa, marasmus, &c. is not relieved by an operation, which, in fact, accelerates the fa-tal termination of the disease.

The simultaneous existence of several white swellings, a radical disease of any vital organ, and, finally, the co-existence of symptoms that indicate the activity of the virus which has produced the disease, contra-indicate the amputating of the limb.

There is another mode of removing the parts diseased by white swelling, besides amputation, which is termed *resection of the bones.* It has been applied to the shoulder, knee, elbow, wrist, and ankle-joints.

The idea of removing the upper end of the humerus, occurred about the same time to White and Vigarous: but the former first published his case. His patient was a young man whose shoulder had been the seat of a large abscess, into which a large incision had been made near the axilla; the head of the humerus, deprived of its capsular ligament, could be distinguished through this opening; matter had insinuated itself under the arm; the patient was exhausted by hectic symptoms. White made a long incision from the middle of the arm to the acromion process. Taking hold of the patient's elbow, he then pushed the head of the humerus upward through the opening, and sawed it off with an amputating saw. The patient was cured in four months; his arm was very little shortened, its form was not altered, and it was as useful as the other.

Vigarous performed a similar operation, two years before White, upon a young man who had caries of the head of the humerus. A single incision was made parallel to the deltoid and the head of the bone; the bone was sawed two and a half inches below its head; but the operation was performed too late, and the patient died. It is to be remarked that the head of the humerus was found separated from the rest of the bone in both these cases. The resection of the head of the humerus has also been performed by David, by Bent of Newcastle, by Moreau, and by M. Roux.

The advantages of this operation are striking and need scarcely be mentioned: It is easily performed; it is not more dangerous than amputation at the shoulder joint, and when it is successful, the extensive movements of the scapula upon the trunk scarcely leave the patient to feel any inconvenience from the union of that bone to the humerus. This operation is also applicable to certain cases of spina-ventosa, caries, fracture of the bone by a bullet, &c.

White's method of operating may be pursued with advantage where the head of the humerus is detached and the glenoid cavity not diseased. Boucher practised it with success in a case where the head of the humerus was shattered by a ball.

But if the head of the bone be not detached, and if it be as large or larger than natural, it would be difficult to press it through a single opening made into a thick muscle and integuments that are swollen and hardened. Bent of Newcastle made first a large vertical incision on the internal side of the arm, and then, from each of its extremities, another perpendicular to the first, and passing horizontally outward; thus forming a long narrow flap, adhering at its external side. M. Sabatier proposes to form a triangular flap, by two oblique incisions—one commencing from the top of the coracoid process—the other from the base of the acromion, and uniting like a V four fingers breadth below the joint. The elder Moreau made two square flaps, the superior adhering to the shoulder, and the inferior to the external part of the arm. M. Roux advises that a single square flap should be made, very much as in La Fayes' method of amputating at the shoulder joint. The joint being thus laid open, the humerus is to be luxated upward and outward. The soft parts are next to be dissected from the bone, and a flat piece of wood is to be introduced behind the diseased portion of the humerus, which is easily sawed off; the circumflex arteries require to be tied; the parts of the glenoid cavity that are slightly affected, should be rasped or cauterized; those more deeply diseased are to be removed with a chisel and mallet. After the flap is replaced, and the elbow somewhat elevated, and bound to the side, the patient is to remain in bed upon his back, that the pus may flow freely through the posterior opening.

If the patient should recover from the operation, his arm will be shortened: in other respects the result of the operation is very different in different cases. The movements of the arm are sometimes entirely restored; while, in other instances, the humerus is capable of no other motions than those which are common to it and the scapula. In White's patient a second joint must have formed, for the arm could be preternaturally twisted on itself. M. Chaussier dissected a patient whose scapula had a round eminence fitted to a corresponding cavity of the humerus. In the third case there remains an interval between the bones, which is filled up with soft parts. The strength of the limb is thus diminished, and its mobility is increased. M. Sabatier has seen two cases of this kind consequent to gun-shot wounds: the utility of the arm and hand was not impaired.

White and Vernamdois have proposed to remove the upper end of the femur in cases of disease of the hip-joint; but such an operation is not justifiable.

Park of Liverpool is the first who devised and executed the operation of removing the extremities of the bones of the knee and elbow-joints. A robust Scotch sailor entered the Liverpool Hospital for a disease of the knee of ten years standing: The joint was much swollen, and the integuments greatly distended; the leg remained immoveably fixed at a right angle with the thigh; the pain was very severe; suppuration and caries had evidently taken place, though the integuments were yet unopened. After several trials on the dead subject, Park sawed off the ends of the bones: hemorrhage, abscesses, and other consequences retarded the cure; but the patient recovered about thirteen months after the operation.

Vernamdois, the Moreaus, father and son, M. Champyon, and several military surgeons have successively performed similar operations upon the knee, wrist and elbow-joints.

Amputation and the resection of the ends of the bones are not to be indifferently performed. The latter operation is not applicable to those cases in which the disease of the bone is very extensive, and the integuments much diseased; nor to those in which the muscles of the hand and fingers are atrophous, as Park states to have been the fact in an instance he met with. Experience does not enable us to decide between the comparative merits of resection and amputation. The latter operation is the more difficult to perform, and more dangerous in its consequences: but when it succeeds, its superior utility is striking—more uniformly so, however, in the wrist and elbow than in the knee, for when even ligamentous union takes place, the limb is always useful; but unless the tibia and femur unite firmly, the leg is rather burdensome than useful. As to the shortening of the lower extremity, which follows the operation of resection, as Park justly remarks, it is a real advantage, for it enables the patient to walk with a stiff knee, without moving his foot in the arc of a circle.

Upon the whole, therefore, we think that a prudent surgeon will abstain from sawing off the bones of the knee and ankle—perhaps also of the elbow and wrist, in cases of white swelling: at the same time we must do homage to the celebrated surgeons whose efforts have been directed to the improvement of our art, and remark, that future experience alone must decide in what cases resection is preferable to amputation.

We shall conclude this chapter with a few remarks on the mode of removing the diseased ends of the bones.

In operating upon the elbow, Park made an incision down

to the olecranon, which he sawed off; the humerus was then
luxated backward, and the end of it removed, as likewise
the ends of the ulna and radius after they were detached
from the soft parts. The Messrs. Moreau and M. Cham-
pyon followed a better method : The patient being laid upon
his belly, or seated in a chair, an incision was made parallel
to the crest over the internal condyle of the humerus, from
a point two inches above the condyle to the level of the
joint ; a similar incision was then made on the opposite
side ; a third, passing transversely above the olecranon,
united the other two. The incisions extended to the bone,
from which the flaps were then dissected. The soft parts
on the anterior surface of the humerus were next detached,
care being taken to keep the edge of the instrument close to
the bone ; the handle of a scalpel was then passed between the
bone and the soft parts, previously isolated, in order to protect
them from being injured by the saw. The lower end of the
humerus was then sawed off, and separated from the liga-
ments that connect it to the bones of the forearm. If the
disease has extended to these bones it is also necessary to
saw off their extremities. For this purpose the external in-
cision is to be prolonged two inches further down; the trian-
gular flap which it forms, with the transverse incision, being
raised. the head of the humerus is sawed off, and by length-
ening the internal incision, the extremity may in like man-
ner be removed. No carious portion of the bone is to be left
behind. The lips of the wound are to be connected by a few
stitches, and the limb is to be placed in a half bent position
upon a pillow filled with chaff.

In the resection of the knee, Park made two crucial inci-
sions upon the anterior part of the joint ; but the following
method of Moreau appears to me preferable: On each side
of the patella, directly before the flexor tendons of the leg,
a longitudinal incision is made, extending from above the
condyles of the femur to those of the tibia ; a transverse in-
cision, below the patella, unites the two, and the flap, in-
cluding the patella, is dissected upward. If the patella is
diseased, it should be removed. The soft parts are then dis-
sected from the posterior surface of the femur, the end of
which is then sawed off and separated from the bones of the
leg. To remove the ends of the tibia and fibula, a longi-
tudinal incision is made along the crest of the tibia, and
the external incision is prolonged until it reach below the
head of the fibula. The quadrilateral flap is then raised,
and the bone sawed off. We need scarcely mention the ne-
cessity of avoiding the large nerves of the blood vessels.

After the operation the limb is placed either in the apparatus for compound fractures, or in a gutter covered with soft substances.

The resection of the bones of the ankle-joint is more difficult than that of the elbow or knee. We begin by making a longitudinal incision from the posterior and inferior part of the external ankle, in a direction upward, and three inches in length; from the lower end of this incision another passes off at a right angle as far forward as the tendons of the peroneus brevis. On the inner side, another incision is made similar to the first, and from the lower end thereof (which is behind and below the internal ankle) another passes off in a horizontal direction, as far as the tibialis anticus: the horizontal incisions divide only the skin, the others extend to the bone. The surgeon now dissects from each side the triangular flaps, and removes the external ankle with a chisel and mallet: the extremity of the tibia is next sawed off, by introducing a narrow saw between its posterior surface and the soft parts behind, while the flesh in front of the bone is protected by the handle of a scalpel held between it and the anterior part of the bone. By twisting the foot outward, the separated portion of the tibia is easily dissected out, and, if necessary, a part of the astragalus is removed. The wound is stitched in two places, and the foot is kept motionless by means of a sole, connected with two splints, applied to the sides of the leg.

The younger Moreau informs us that he has successfully resected the bones of the wrist-joint. He does not state in what manner. M. Roux advises that incisions should be made along the external edge of the radius, and from the internal edge of the ulna as far forward as possible, without injuring the large nerves and blood vessels, and terminating inferiorly opposite the joint; two transverse incisions, an external and an internal, beginning from the lower ends of these, reach backward as far as the extensor tendons, on the posterior surface of the joint. The lower ends of the radius and ulna are then successively laid bare and sawed off, and as many of the carpal bones as are diseased are removed.

CHAPTER XLIII.

Of Anchylosis.

BY the term *Anchylosis* is understood that state of a dia-throidal articulation in which the movements of the bones that form it are entirely or almost lost.

Anchylosis is distinguished into complete and incomplete. In the former the bones are united together and continuous : in the latter, on the contrary, they are still moveable in a slight degree.

Diseases which obstruct the movements of a joint, such as tumours, &c. should not be confounded with anchylosis. In some instances all the bones of the body unite to each other—but the disease is most commonly confined to a single joint, and the ginglymoid joints are much more frequently affected than the orbicular joints.

Simple immobility of a joint, continued for a great length of time, may render it stiff. The Fakirs of India, who re-main several years in the same position, doing penance, produce anchylosis, in a greater or less degree, of almost all the joints. But this affection is almost always a conse-quence of fracture, luxation, sprain, wound of the joint, white swelling, and dropsy of the joint. Exostosis, or ossi-fication of the cartilages and ligaments, aneurism, wens, large abscesses, ulcers, burns, and gangrene, may also give rise to it.

Anchylosis is also a termination, and not an unfavourable one, of certain diseases of the joints, produced by syphilis, gout, scrofula, and rheumatism.

A certain degree of motion is necessary to promote the due secretion of synovia, to keep the ligaments supple, and to preserve the contractile power of the muscles. When a joint remains at rest for a long time, its surfaces lose their polish, and are incapable of sliding upon each other ; the ligaments become stiff, and prevent motion of the joint ; the muscles become weak by inactivity ; they contract, and be-come rigid, and the weakness of the circulation in the soft parts around the joint renders them edematous.

If, under these circumstances, the synovial membrane and articular surfaces become inflamed, they may adhere to each other in the same manner as the lungs adhere to the pleura costalis, or the liver to the peritoneum. This con-nexion of the articular surfaces, observed by Hunter in se-veral instances, is different from that species of anchylosis

which arises from the ossification of the ligaments and the growing of the bones together, in consequence of granulations arising on their surfaces and secreting phosphate of lime. In the latter case the two bones become as one; whereas, in the former, if by any violence they are separated, their movements may be re-established. Job of Meekren* relates a case of anchylosis of the elbow, to which fomentations and poultices had been applied without success. The patient had a severe fall upon the forearm; from that time it became moveable, and it was finally restored to the full exercise of its functions.

The stiffness of joints, which arises in consequence of long rest after fractures that are not very near the articulations, merely requires that the limb should be gradually moved, as soon as the callus has acquired sufficient solidity; but when the bone is broken near its extremity, inflammation is apt to extend to the joint and augment its stiffness; and if any circumstance render it necessary to continue the part in a state of rest for more than the usual time, it may be very difficult, or impossible, to restore the flexibility of the joint, and the articular surfaces may even become united together. J. L. Petit attributed the rigidity of joints, after fractures of the middle of the long bones, to the accumulation and thickening of synovia. Dissection has proved that joints rendered stiff by fracture contain a small quantity of synovia; that this fluid is not thickened, and that the rigidity depends, in these cases, entirely upon the ligaments, tendons, and other soft parts.

The same author attributed the anchylosis that follows fractures in the vicinity of the joints, to the effusion of an osseous juice which thickens in the joint: but this hypothesis is contradicted by the fact that no bony formation, arising from the effusion and condensation of an osseous juice, has ever been discovered in a joint. We find, however, in the fifth volume of the Memoirs of the Academy of Surgery, page 84, a singular case of irregular ossification, in consequence of a fracture of the upper part of the femur by a ball; this case was supposed to establish Petit's theory.

It is easy to conceive how an unreduced luxation may produce anchylosis. In the orbicular joints the movements may be gradually restored in a very considerable degree; whereas, in the ginglymoid joints, unless motion be communicated to the limb every day, complete anchylosis will re-

* Observation lxiv. p. 297.

sult; and the utmost care can only restore it to a very li-
mited exercise of its functions.

Luxations of the ginglymoid joints that have been re-
duced, and even sprains, may produce an incomplete anchy-
losis; inasmuch as it is necessary to keep the part in a state
of rest for a great length of time.

In the chapters on wounds and dropsy of the joints, we
have sufficiently explained the manner in which anchylosis
may take place, and how it should be treated.

The retraction of the flexor muscles of the leg, which
almost uniformly occurs in white swelling, keeps the limb
completely motionless, and when all the other symptoms
have been relieved, the joint still remains stiff, and every
attempt to extend it excites great pain. The immobility is so
great as to lead to the belief that the bones of the leg
and thigh have united together by granulations from their
respective surfaces; but this is, in fact, a rare occurrence,
and, in almost all cases, the rigidity in question depends
upon the retraction of the muscles and the stiffness of the
ligaments and tendons; as is proved not only by dissection,
but by the fact that persons in this situation are often cured
by the long-continued use of emollient applications.

In scrofulous white swellings, to the other causes of in-
complete anchylosis is added an enlargement of the ends of
the bones. Long-continued retraction of the muscles and
rigidity of the ligaments and tendons may produce an im-
moveable stiffness of a joint, though the bones be not
united to each other. I have met with several cases of this
kind consequent to rheumatic white swelling. Any attempt
to have moved the joint would have torn the muscles and
tendons.

Complete anchylosis may follow white swelling, a wound
of the joint, and, in general, any disease in which the arti-
cular surfaces are ulcerated. It is to be considered as a
happy termination of those cases, and the surgeon should
endeavour to promote it by keeping the limb perfectly at
rest, and in a position that will best fit it for future uses.

A large abscess, situated near a ginglymoid joint, by de-
stroying the cellular substance, may cause the tendons to
adhere to the adjacent parts, &c. firmly. This adhesion, con-
nected with the thickening and stiffening of the ligaments, in
consequence of inflammation, is a frequent cause of an-
chylosis.

When the skin and cellular substance around a joint are
destroyed by gangrene, or by a deep burn, beside the adhe-
sion of the tendons, and the stiffness of the ligaments which

follow the cicatrizes, form bands that obstruct the movements of the articulation.

Anchylosis, arising from these causes, is generally curable; but no relief can be afforded in those cases in which the tendons, deprived of their nourishing vessels, have exfoliated. Thus, in some cases of whitlow, the flexor tendons sloughing off, the finger is left in a state of permanent and incurable extension.

In gouty persons, the articular ligaments are often incrusted with a white friable substance, containing a large proportion of the phosphate of lime. These incrustations very much limit, or even prevent the motions of the affected joints.

Bony matter may be deposited in the substance of the ligaments, and render them absolutely immoveable. In the skeletons of aged persons, we often find the ligaments of the pelvis, of the vertebral column, and several ribs, completely ossified, so that several bones are united into one. Hard labour often produces the same effects. They are not to be regarded as a disease, and should be distinguished from the general disposition to anchylosis, of which we find several cases in books: the patients had generally been rheumatic for a long time, and after death the ligaments of almost all the joints were found so completely ossified that the skeleton seemed to be formed of only one bone.

To distinguish complete anchylosis from incomplete, we should bear in mind, that absolute immobility is a characteristic of the former. This sign is not absolutely conclusive; but by considering whether the cause of the disease was of a nature to produce an ulceration of the cartilages of the joint, we shall, in general, be able easily to determine whether the bones have grown together or not. The distinction is important, inasmuch as complete anchylosis is incurable, and violent attempts to move the bones would do great mischief.

Incomplete anchylosis, on the contrary, is almost always capable of being removed. In ginglymoid joints, and in cases of long standing, it is more intractable than when it is seated in the orbicular joints. Age also adds to the difficulty of effecting a cure.

Except when anchylosis is seated in the lower jaw, it is never dangerous. In that case, however, it may cause marasmus, by preventing the patient from taking solid food.

In all cases where a false anchylosis is to be apprehended, the limb should be cautiously moved by the surgeon, in order

to prevent that occurrence. This precaution is especially necessary in the ginglymoid joints.

When these means have been neglected, or employed without success, and a joint has become rigid, the first cura-tive indication is to restore the natural flexibility and exten-sibility to the ligaments and muscles. For this purpose va-rious remedies have been employed; such as baths—lotions, with a decoction of marsh-mallow or linseed, or of broth made with tripe—vapour baths—pumpings of warm water, and afterwards of a warm solution of muriate of soda, or of ammonia—warm sulphurous waters—frictions, with cold-pressed olive oil, and other fatty substances—the applica-tion of the omentum of a recently killed lamb to the joint, or of a fresh warm sheep-skin—plunging the limb into the body of an animal just killed, &c.

A surgeon should select from these remedies such as may best suit the circumstances of his patient. Several of them may be employed conjointly: thus, after having bathed the part, or exposed it to the vapour of warm water, or to the momentum of a column of falling water, we may direct it to be rubbed with hot olive oil for the space of half an hour. The frictions should not be confined to the joint, as commonly advised, but should extend over all the fleshy part of the retracted muscles. The bath and friction should be operated at least twice a day. Thus we may use, at the same time, fomentations and emollient poultices, baths, pump-ings, and frictions. If the cellular tissue be swollen, after having employed emollients for some time, we may add to them resolvents.

As soon as the ligaments and other soft parts begin to re-lax, we should move the limb. If the knee be the part af-fected, we should cautiously flex and extend it; but without violence, and slowly; otherwise we might occasion dangerous inflammation. During the first trials, a crackling noise is heard. This arises from the stretching of the ligaments, and the friction of the articular surfaces deprived of the fluid, which naturally lubricates them. As soon as the sy-novia begins to be secreted, and the ligaments are elongated, the crackling is no longer heard. It would be improper for a surgeon to trust to another person, unless very intelligent, the making of these movements. Fear of pain would pre-vent the patient from having the proper motions communi-cated to the joint, and most probably the movements of the joint above that which is stiff would be mistaken for those of the diseased joint.

When the anchylosis is of long standing, and the retraction of the flexor muscles very great, it is often necessary to use considerable force to lengthen them: for this purpose we may employ with advantage mechanical means, not only to elongate their fibres, but also to prevent them from retracting. Hildanus successfully applied a machine, of which we find an engraving in his Surgery, to extend the knee and elbow affected with false anchylosis. We have used a contrivance nearly similar with the greatest advantage. These machines extend the limb in a very gradual manner, and are particularly useful when the rigidity of the joint depends upon a spasmodic contraction of the muscles. In cases where machines are not necessary, it is useful to apply a long splint of wood on that side of the limb toward which it is flexed. When the forearm is stiff, and in a state of flexion, we may employ a remedy which Hildanus says he found successful in several instances, which consists in making the patient carry a weight with the hand, and gradually augmenting it.

This treatment often succeeds beyond all expectation. We might relate several examples of its extraordinary success; but we shall confine ourselves to the following, from J. L. Verduc:

A girl, aged ten or twelve years, had anchylosis of the right knee, in consequence of a wound between the condyle of the tibia and the patella. The heel had been drawn up against the buttock for seven or eight months. Several surgeons regarded the disease as incurable: notwithstanding which Verduc undertook to remove it. He began by employing emollients; after which he used resolvents. These remedies were applied twice a day for the space of five months. After fomenting the part for half an hour with an emollient decoction, as hot as could be borne, a very hot resolvent liquid was poured upon the part.

When the limb had become capable of a small degree of extension, the leg was moved upon the thigh as long as the little girl could endure the pain. A very thin splint, an inch in breadth, and nearly a foot in length, was then applied behind the knee, and secured by a roller. As there was still a space between the splint and the ham, a very thick compress, enclosing a piece of stiff pasteboard, was laid over the knee, and several turns of a bandage were passed over the whole.

Every morning and evening the leg was flexed and extended forcibly. At these times a noise was heard, which arose from the rubbing of the condyles of the femur against

those of the tibia. The patient suffered great pain from these operations, and it often became necessary to desist from them for seven or eight days together until she recovered. By these means the anchylosis was perfectly cured, and the girl now walks without limping, or experiencing any inconvenience.*

CHAPTER XLIV.

Of certain Deformities, produced by Derangement of the Natural Relations of Articular Surfaces of the Bones, coming on gradually, and without External Violence.

THE bones are not intended merely to support other organs. On some of them depend the size, the direction, and the form of the human body, and of each of its constituent parts; and every change in the shape or natural direction of the bones necessarily produces more or less alteration in the external form of the body and deformity.

Some deformities arise from a swelling, softening, and bending of the bones; as we observe in rickets. Others are the result of a slow and gradual deviation of these organs from their proper places, without any remarkable change of form or size. We shall here treat of these last: we have spoken of the others in a former chapter.

When one or more bones are kept in the same position for a certain length of time, their articular surfaces acquire an unnatural shape, and, if they harden in that position, a deformity is produced, which art may prevent in its early stages, before the ossification is completed; but which is incurable when the bones have become hard and attained their full size.

We proceed to consider the consequences of this unnatural direction of articular surfaces in different parts of the body.

The head is naturally disposed to incline forwards, because its centre of gravity is anterior to its articulation with the first cervical vertebra. This tendency is constantly

* L. Verduc, Traité des Bandages, chap. xxxv. p. 172.

counter-balanced by the action of the posterior muscles of the neck, which gives the cervical vertebræ a slight convexity behind. To this general cause of unnatural flexion of the head forwards are sometimes added others, such as short-sightedness, or mere weakness of sight, and the bad habit of looking at objects very near the eyes, when these organs are capable of distinguishing them at the usual distance. In all these cases, the constant inclination of the head forwards prevents the anterior parts of the cervical vertebræ from acquiring their natural thickness, and, if the bones become hard in this position, it is impossible to straighten the neck, and the head always remains bent forwards.

The habit of leaning forward commonly commences when children begin to read and write. We ought, in these cases, to raise the book or the paper, and not suffer them to incline the head forwards: for this purpose a high table is necessary. The child should also sleep without a pillow. It is very useful to place something on the head, a little before the apex, and make the child carry it. By engaging him in a play of this kind he will soon hold up his head habitually.

If the neck be very considerably bent forwards, and the above mentioned means have not proved sufficient, the child may wear a piece of leather, or thick pasteboard, around the neck.

If the situation of the patient admit of it, we may derive still greater advantage from the use of a machine so constructed as to support the chin in an easy manner.

Children often acquire the habit of inclining the head to one side from sleeping constantly in a situation in which the light always reaches them in the same direction. We may remedy this deformity by changing the position of the cradle. If the child is in its second year, the parents should give him his toys on the side opposite that toward which his head is inclined.

If these means should not be sufficient we may apply a bandage, or a suitable machine for keeping the head in its proper position, and it will be useful to employ emollient applications to relax the retracted muscles on that side toward which the head is inclined.

The shoulders are liable to various deformities, each of which we shall successively consider. When the shoulders are preternaturally raised, the neck appears short, and in a

manner buried between them: this deformity, though almost always congenital, may also be acquired by the habit of continually raising the shoulders. In order to prevent it, we should carefully avoid, 1st, Raising children by the arms; 2d. Making them sit upon chairs, the arms of which are so high that they are obliged to raise their shoulders in order to rest their own arms upon them; 3d. Placing them in the gocarts that are used in some countries: these machines have the double inconvenience of raising the shoulders too much, and making children, who are too weak to bear their weight on their legs, to support themselves on their arms; 4th. In the last place, we should avoid letting them write, read, or play upon a table which is too high.

In some cases the deformity of which we are treating is confined to one shoulder. If this do not depend upon a lateral curvature of the vertebral column, we may be certain that it is the effect of a bad habit, which has been contracted, of standing constantly upon one foot, which ought to be corrected without delay. We may even cause the child to stand occasionally upon the foot corresponding to the side of which the shoulder is depressed. These means will be found sufficient to correct slight deformities; but where the difference in the height of the shoulder is considerable, we should cause the child to wear a corset, of which the opening for the arm corresponding to the depressed shoulder, is higher than that of the opposite side.

Some have very incorrectly imagined, that the elevated shoulder might be depressed by placing upon it a weight, such, for example, as a piece of lead; but experience and sound philosophy unite in rejecting this remedy, the effect of which would be, in fact, to raise the shoulder it was intended to depress, as by that means only the equilibrium of the body can be preserved. We may apply a weight with advantage to the depressed shoulder, or make the child carry something heavy with the hand or arm of that side; or we may give him a long cane to hold in the hand of the depressed side, or a short one for the opposite hand.

Children who contract the habit of bringing their arms forward, and resting them against the anterior part of the body, soon have round shoulders. In this situation of the arms, the shoulder-blades are removed from the spine, and correspond to the most convex part of the ribs, which pushes them backward, and causes them to project under the

integuments; the clavicles become almost transverse; the resistance which they oppose to the scapulæ, to prevent them from coming forward, exposes those bones to a pressure, which increases their curvatures and shortens them. If they harden in this situation, they prevent the shoulders from going back, and the person is ever afterward round shouldered; while, at the same time, the anterior and superior part of the chest is much flattened.

To prevent this deformity, the children who are acquiring it should be made to wear corsets, which keep the shoulders back; as they grow up we may make them take hold of a long stick, while their arms are extended horizontally, or make them cross their arms upon the sacrum or loins. They should sleep upon a flat bed, without any pillow.

Lastly, we may use with advantage a broad bandage, passing in front of the shoulders and crossing behind the back in the form of the figure 8.

The dorsal and lumbar vertebræ are not less exposed to be deformed by bad habits than those of the neck.

In the natural state, the vertebræ of the back are convex posteriorly, and those of the loins anteriorly; there is no lateral inclination, except a very slight one to the left, near the third or fourth vertebra of the back; these curves do not exist in very young children.

A deformed curvature of the spine may arise from several causes in the most healthy persons, and at any age. Work which requires constant stooping; the habit of carrying burdens upon the head or shoulders; the habitual use of the hoe and pick-axe may occasion it. Almost all old vintagers are much bent down, and it is well known how great a tendency old age has to bow down the head and increase the natural curvature of the back.

When, from any causes analagous to those we have mentioned, a child is acquiring a habit of stooping forward, in addition to a judicious use of the means we have recommended for straightening the neck, it will be proper to prescribe tonics and a strengthening regimen; for a weakness of the muscles of the back is often the sole cause of the deformity.

It is, however, very rare, that a bad habit produces any alteration of the spine. When, therefore, we see an infant deformed in that manner, we should inquire if there be no spasmodic contraction of the muscles of the trunk : in most

cases, however, we shall find the evil to originate in an inter-
nal disease, affecting the bones, and of which muscular
weakness is but a symptom.

We shall proceed to show how deformity of the spine may
take place.

If the muscles of one side act with greater energy than
those of the other, they necessarily incline the vertebræ of
that side toward them.

Early youth is more subject than any other period of life
to gibbosity and spasmodic diseases, and we often see muscu-
lar action alone produce a deviation of the spine; but these
causes must continue to act some time for the bones and
inter-vertebral substances to become affected. I have twice
known a spasmodic contraction of the sterno-cleido-mas-
toidens, which had not continued long enough to have pro-
duced this effect, followed by so great a shortening of that
muscle, that it was impossible to keep the head from rest-
ing upon the corresponding shoulder, even after the spasm
was removed.

The treatment of cases of this kind, consists in the early
and assiduous application of warm baths, camphorated and
opiate liniments, fomentations, poultices, sulphurous wa-
ters, pampings, &c.—selecting those which appear best
adapted to the cause of the disease.

Preternatural inflexions of the spine are rarely produced
by the causes of which we have just spoken, unaided by some
general and local disease. We have elsewhere treated of
rickets and of caries of the vertebræ. What we are going
to say relates exclusively to affections of the spine, occuring
a longer or shorter time after the first dentition of children,
who, without being decidedly rickety, have some latent dis-
ease of the spine or other bones of the joint. These devia-
tions occur in children born of parents affected with scro-
fula, syphilis, cachexia, exhausted with age and indulgence
with women; or whose nurse, having some of these com-
plaints, affords little or no milk, and supplies its place with
boiled meat, or who suckles during pregnancy. Children in
whom none of these circumstances obtain sometimes be-
come affected with a curvature of the spine during their con-
valescence from acute diseases, especially eruptive diseases,
such as small-pox, measles, &c. above all, when they are
exposed too soon to the open air, without being clad suffi-
ciently warm.

Curvatures of the spine commonly appear from the age of
six years to that of fifteen, and are much more frequently
met with in girls than in boys. The dorsal portion of the

spine is almost always the principal, sometimes the exclu-
sive seat of the disease; but sometimes, also, the lumbar
vartebræ are affected. The inclination is seldom either for-
ward or backward, but almost always lateral, and from the
right side to the left. When both the dorsal and lumbar
vertebræ are affected, they form curves in opposite direc-
tions like those of an italic *S*.

The effect of curvatures of the spine upon the form of the
chest is very remarkable. The ribs which are attached to
the convex side of the spine, become more curved back-
ward, and push out the scapula, while the anterior portion
of these ribs is straightened: the intercostal spaces are thus
increased. These effects are reversed on the opposite side.
There the chest is flattened, the ribs are approximated,
the pap becomes more prominent, without being, in fact,
larger; and the scapula, although not smaller, projects much
less.

When the deviation depends exclusively upon an affection
of the vertebræ, the movements of the thorax are seldom
impeded; but when the ribs are also involved in the disease,
respiration is rendered difficult and laborious.

The deformity of which we are treating usually takes
place at an age when the pelvis has already acquired a con-
siderable developement and solidity : hence that part is rarely
distorted, except in cases where the deviation of the spine is
very great, and involves the dorsal and lumbar vertebræ:
the direction of the pelvis in relation to the spine then be-
comes changed, and one of the hips is higher than the other.
Not so when the curvature takes place in a rickety child, all
of whose bones are equally softened. In these cases, the
pelvis partakes of the deformity; in the former the spine
only is distorted.

The deviation of the vertebral column takes place in a
manner so slow and gradual, that it is not generally noticed
until it has made considerable progress. One shoulder is
observed, indeed, to be raised, and to project more than the
other; but this is attributed to the child's having acquired
the habit of leaning to one side, and nothing more is done
than telling him to constantly hold himself straight, and me-
dical advice is not asked until the evil has become irremedi-
able.

It is of great importance to discover the disease at an
early period, and to prescribe such remedies as its internal
euase renders necessary. A scrofulous taint is undoubtedly
the most frequent cause of this affection; but the other

diseases we have mentioned also give rise to it, and require appropriate treatment.

The medicines that have been given with most advantage in scrofula, are bitter tonics, antiscorbutics, chalybeates, antimonials, sulphurous and chalybeate water, the carbonates of potash and soda. We should prefer mercury in all cases connected with syphilis, (whether inherited or not,) or with an abuse of remedies for the cure of that disease. It is, undoubtedly, the prevalence of the scorbutic taint, in large cities, that has led to the great success from the use of the *sirop antiscorbutique,* in the practice of Messrs. Portal and Salmade. Bark, and its different preparations, a strong decoction of hops, of the root of burdock, or of gentian, are the tonics which have proved to be most useful in cases of scrofula connected with debility.

When it is practicable, the patients should also remove to a pure, warm, and dry air, to a situation with a southern aspect. Frequent exposure to the sun, with the proper precautions for the heat, and the use of stoves in winter, are very beneficial.

The clothing should always be warm for the season ; flannel should be worn next the skin ; the patient should be rubbed with flannels impregnated with an aromatic vapour, or with alkoholic or balsamic liquors, such as lavender water, &c. The diet should be light, easy of digestion, and very nourishing. It should consist of the flesh of grown animals, such as beef and mutton, sapid and red meats ; and succulent roots, such as those of carrots, turnips, parsnips, &c. together with antiscorbutic plants, such as onions, leeks, water-cresses, &c. Milk, and green or wilted fruit, and farinaceous food, must be forbidden : a moderate quantity of coffee or chocolate is useful : good old wine, with water, and occasionally without it, is the best drink.

The exercises of walking, running, swimming, wrestling, and whatever tends to impart strength to the body, will be found highly beneficial. The muscles of the side on which the spine concaves, which are always weaker than those of the opposite side, should be invigorated by frequent exercise. In fact, the particular exercise of these organs is the best means to correct the deformity. To fulfil these indications, the child ought to be engaged in play with a kite, a ball, drawing a waggon with a cord, &c. or raising a weight with a pulley.

We have had a wheel constructed to be turned by children. It is supported vertically. The winch by which it is

moved in its greatest ascent, is raised as high as the child can reach. Thus it brings into action precisely those muscles which we wish to strengthen, and is extremely useful, not only in cases of deformity of the spine, but also of malconformation of the chest.

Whale-bone corsets, and other machines for correcting these deformities, are, in general, more injurious than useful.

Judicious treatment will greatly diminish, though it will seldom entirely remove considerable deformities of the spine. But some cases admit of little relief.

Weakly children, when they begin to walk, often become knock-kneed, or bow-legged : sometimes on both, and sometimes on only one side.

This is particularly apt to be the case with children who have used gocarts, which throw the weight of the body upon the legs before they are able to support it. The deformity sometimes takes place as late as the age of twelve years, but generally much earlier.

It is easy to conceive how the knee may be bent in, if we reflect that the ossa femoris pass obliquely downward and inward, while the upper surface of the tibia is horizontal, and the internal condyle of the femur lower than the external. This structure, a necessary consequence of the breadth of the pelvis, is more remarkable in females, in consequence of the greater width of the female pelvis, and the greater separation of the upper portion of the thighs. Thus the knees have a natural tendency to bend inward.

For these reasons, also, it rarely happens that deformity takes place, in a contrary direction, to any considerable degree, and it is generally accompanied with a curvature of the femur and of the tibia, which is not the case when the knee is turned inward.

There is a constant relation between the direction of the femur with respect to the tibia, and that of the tibia with respect to the astragalus. In the natural state, the femur forms with the tibia an obtuse angle, salient on the inner side ; the tibia forms with the astragalus a similar angle, though less marked. When the inclination of the femur with the tibia is increased, that of the tibia with the astragalus is increased also : the foot is consequently turned outward, and the weight of the body is supported chiefly by the inner side of the sole.

In the second case, when the knee is bent outward, the weight of the body is borne chiefly upon the outer edge of the foot.

Debility is the cause of these deformities. To prevent them, we should leave children to themselves until they are able to walk without assistance. This rule is applicable to all children, but ought to be particularly observed in regard to those who, in their first attempts to walk, place their knees together.

In addition to these precautions, it is often necessary to use topical and general tonics, and to apply mechanical means capable of remedying the deformity. During the night we should place, on the external side of the leg, a wooden splint, covered with a soft substance, and confined to the limb by a roller moderately tight. During the day, the child should wear a laced boot, of which the sole is thickest on that side toward which the knee is inclined. Thus, when the knee is turned in, the sole should be thickest on the inner side of the foot, and *vice versa.*

The efficacy of this remedy is proved by daily experience. To derive from it the greatest advantage, it should compress the foot so as to prevent it from turning, and the lower surface of the foot should be kept in contact with the upper surface of the sole of the boot, and that part of his sole which is to be thickest should receive additions from time to time, and the inequality should be gradually carried to an extent proportioned to the deformity. It is necessary, of course, to persist in this treatment for a considerable length of time—more or less, according to the extent of the deformity and the age of the patient.

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The soles of the foot, in the natural state, should press horizontally against the ground. If the foot touch the ground only by its internal side, or by its external side, the deformity is called a club-foot. The French term *équin* designates those cases in which only the point of the foot touches the ground. The Romans applied the term *varri* to those whose feet were turned inward, and *valgi* to those whose feet were turned outward. The former is the most frequent. The other varieties of this disease are very rare. One foot, or both, may be deformed.

Congenital deformities of the foot have been attributed by some to the uneasy position of the child in the womb; by

others to the imagination of the mother. Neither hypothe-
sis is satisfactory.

The causes of deformity of the foot, after birth, are
fractures, luxations, abscesses, laxity of the ligaments, the
spasmodic contraction or relaxation of the muscles. Duver-
ney considered the last as the sole cause of the club-foot.
He grounded his opinion upon the constant flaccidity and
atrophy of the muscles destined to move the foot in a direc-
tion opposite to that in which it is twisted. Scarpa, on the
contrary, asserts that this relaxation does not precede, but
that it follows the deformity. We believe that, in different
cases, the relaxation may be both a cause and an effect of
the twisting of the foot. Children deform their feet by
walking on one side when the opposite side is tender, in con-
sequence of its being the seat of a pustule, wound, &c. es-
pecially when parents and nurses are in too much haste to
make them walk.

When the foot is turned inward only in a slight degree, its
inner edge is still capable of being made to touch the ground
when the foot is pressed strongly against it. But when the
deformity is more considerable, the whole weight of the
body is borne by the external edge of the foot and the exter-
nal ankle; the back of the foot becomes very convex, and
the sole very concave; the great toe is separated from the
rest, and is commonly pointed inward and upward; the two
great toes sometimes touch each other in cases where both
feet are deformed, and there is, of course, great difficulty
in walking.

Scarpa has discovered, by dissection, that the astragalus
does not commonly participate in the deformity of the club-
foot. It is important to recollect this fact in the application
of machines. Scarpa also found that the bones of the tar-
sus are not luxated in these cases, as was believed, but only
turned in the direction of their shorter diameter. The mu-
tual relations of these bones are not completely changed un-
til a very late period of the disease.

The probability of removing or diminishing this deformity
is in proportion to the facility of returning the foot to its na-
tural situation. Except in cases where the bones of the tar-
sus are anchylosed, the curative indication is always the
same, viz. to draw the foot gradually towards its proper
place by an external force, without occasioning pain, or great
inconvenience, and without preventing the patient from
walking while it is applied.

Hippocrates well knew the advantages of suitable ma-
chines, and Hildanus invented one which he applied with suc-

cess.   Scarpa has also invented a very ingenious contrivance
for the same purpose.   It appears to me, however, to be un-
necessarily complicated.

We have employed, with great advantage, a more simple
machine than that of the celebrated professor whom we
last mentioned.   It consists of a sole, to the heel of which
is attached a plate of iron, consisting of two parts, one ho-
rizontal, and the other vertical; the former passes between
the two pieces of leather of which the heel is composed,
and is fastened by a rivet; the latter rises about two inches
above the sole: its upper end is somewhat longer than the
rest, and receives a screw riveted to the end of an elastic
plate of iron, the breadth of which is one inch, and its
length sufficient to extend above the calf of the leg.   This
plate is covered with velvet, or some other soft substance,
and its spring is proportioned to the force we wish to employ.
The sole also consists of two parts, a posterior and an ante-
rior; to the first, which forms the heel, is attached the
quarter; the second is the sole, properly so called.   It sup-
ports the upper-leather, which has no connexion with the
quarter, and should be made of thick calf-skin, lined with
sheep-skin.   The posterior and concave part of this piece
is to correspond with the convex and anterior part of the
posterior piece.   Each of these parts is formed of two
pieces of leather which are laid upon each other.   A plate
of iron, almost as large as the posterior piece, is then placed
between the skins which form it, and riveted there.   The
middle and anterior part of this plate is traversed by a screw,
which extends about two lines below it, and is riveted above.
This screw corresponds to the centre of a second opening
made in the lower piece of leather, and about eight lines
in diameter; in this opening lodges a screw, of which we
shall speak presently.   Another plate of iron, an inch in
length, passes between the whole length of the anterior part
of the sole, to which it is riveted, and extends back to the
screw with which the posterior plate is armed, and is con-
nected to the two pieces of leather which form the posterior
part of the side, and terminates in a large round head, the
centre of which has an opening for a screw, and is of suffi-
cient size to permit the plate to move freely around the
screw.   A round nut, with apertures in its sides, so as to be
turned with a forked screw-driver, fixes the anterior part of
the soles in any position we wish to give the feet.   The up-
per leather is divided lengthwise, and the boot is laced
on the top of the foot. The machine is kept on by a leathern
strap and buckle over the instep, and another strap, much

broader than this, and made of linen covered with velvet, to
go around the leg, opposite to the upper end of the elastic
plate. It is tightened by means of a buckle.*

During the course of the treatment, we may employ a
plate with a stronger spring than that first used.

It need scarcely be stated, that neither this nor any other
machine should be employed to deformities that are the ef-
fects of rickets, of white swellings of the ankle joint, or of
gouty or rheumatic affections of this part.

The symptoms which accompany the turning of the foot
outward. and the method of removing it, will be easily un-
derstood by what has been said of the opposite deformity.

The deformity of the foot which consists in an elevation of
the heel and depression of the toes, depends sometimes on a
luxation of the foot forward, and may also arise from the
disproportionate strength of the external muscles. In this
case, the toes and corresponding extremities of the meta-
tarsal bones alone touch the ground; they form a right angle
with the rest of the foot: the skin, which covers the plantar
side of the toes, becomes thickened, and the patient walks
and stands unsteadily. Scarpa has proposed, for the cure
of this deformity, a machine so constructed, that in propor-
tion as the foot presses against the ground, its anterior part
is gradually raised to a level with the heel.

The wearing of narrow shoes often causes the extremity
of one of the toes to rise over that which is next within it,
and cross it at an acute angle. If this deformity exist in a
great degree, and especially if it extend to several toes, it
may render walking difficult and painful. In the commence-
ment of this deformity, the wearing of broad shoes, and the
proper application of a small bandage will remove it; but
when it is of long standing it is incurable : those who are the
subjects of it are obliged to wear broad shoes ; and to place
cotton each side of the deformed toe, to prevent the upper
leather from pressing upon it.

The first phalanx of one of the toes, most commonly that

* This machine, and the other which we have described, were made by
M. Oudet, an excellent artist, who lives at Paris, in the Rue des Fosses
Saint Germaine-des-Pres, No. 18

of the third, may rise a little, so as to form an obtuse angle
with the first bone of the metatarsus which supports it. while
this phalanx is also extended. and the second and third pha-
langes are more or less flexed, so that the end of the toe
touches the ground in walking and standing. The toe be-
ing thus compressed between the sole and the upper leather,
becomes painful, and sometimes ulcerates. Walking, of
course. is rendered extremely painful; and persons thus
affected are at all times incapable of walking far, especially
if the end of the nail touch the sole of the shoe.

This deformity is the result of a slow and gradual relaxa-
tion of the extensor muscle. When it is not considerable,
the toe may be replaced in its proper situation; but as soon
as it is left to itself, it returns to its unnatural place. When
the disease is carried to a great degree, the toe is retained in
its deformed situation, not so much by the retraction of the
extensor muscle, as by the change in the articular surfaces
of the bones.

When proper precautions have not succeeded in preventing
this deformity, it may be remedied by an operation which I
have twice performed with the greatest success, and which
consists in dividing and removing a transverse portion of the
retracted muscle. The first person on whom I performed
this operation, was a young man, seventeen or eighteen years
of age, the little toe of whose left foot was deformed in the
way we have mentioned. It could be easily replaced, but it
immediately returned to its unnatural position. The tendon
of the extensor muscle raised the skin along its course, and
formed a remarkable projection, which disappeared the mo-
ment the toe was put into its proper place. The young man
not being able to walk without great difficulty, although he
wore very large shoes, was willing to suffer any operation
that would relieve him. I made an incision, about an inch in
length, along the extensor tendon, and divided it. The two
ends immediately retracted, and left a large interval between
them; which was still more increased when the toe was re-
stored to its situation. I confined it in this position by means
of a small bandage that pressed it against the next toe.
The incision was brought together by sticking plaster: it
healed in four or five days. The use of the bandage was
continued until the toe remained in its natural place without
its assistance. Then the cure appeared complete; but the
two ends of the divided tendon soon became re-united by
means of a hard and solid substance, and at the expiration
of six months, the deformity was as great as ever. I pro-
posed to the patient to remove a portion of the tendon, and

he submitted to it. By an incision similar to the first I removed an inch and an half. The subsequent treatment was the same as in the preceding case, and the relief was permanent. It is proper to observe, that the first division of the tendon was made at the upper end of the incision.

A little girl was born with a foot twisted inward. The deformity was removed by the use of the machine we have described, but the great toe remained drawn up by the retraction of the extensor muscles, which also turned the point of the foot inward. The removal of a portion of the tendon of the muscle completely cured her.

When there is no other resource, it becomes necessary to amputate the toe. A young man, seventeen or eighteen years of age, was the subject of a great deformity of the third toe of each foot, which almost prevented him from walking. I removed the toe, and he afterwards walked with the greatest ease. Most of the family were the subjects of similar deformity.

TRANSLATOR'S NOTES TO VOLUME II.

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NOTE A, p. 39.

THE late Mr. Birch, one of the surgeons of St. Thomas' Hospital, (whose assiduity in the instruction of his pupils it would be unjust not to mention with gratitude,) informed me that he had succeeded in procuring a firm osseous union, in several cases of ligamentous connexion of bones after fracture, by means of electricity. He stated, that, in his hands, that remedy had never failed of success. One of his dressers, with whom I was intimately acquainted, saw two cases in which it produced the most happy effect.

One of these patients, whom I often visited during his illness, entered St. Thomas' Hospital in the month of January, 1812, with an unconsolidated fracture of the tibia, below the middle, of thirteen months standing. The leg below the fracture could be easily moved in any direction, and without exciting much pain.

Shocks of electric fluid were daily passed through the space between the ends of the bones, both in the direction of the length of the limb and that of its thickness. The man, being somewhat weak, used bark and porter at the same time. After the limb was electerized, the ordinary apparatus for fractures of the leg was applied. At the expiration of two weeks the limb had evidently become less flexible in the situation of the fracture; and after a continuance of the same treatment for six weeks, the man was able to walk, and left the hospital cured.

In a recent British publication it is stated, that blisters have been applied, in a similar case, with success.

We should certainly cause a fair trial to both these remedies before resorting to so serious an operation as that of introducing a seton between the bones.

A late English surgeon, who has written upon this subject, proposes the introduction of a seton, as originating with himself.

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NOTE B, p. 55.

A sailor had several of his ribs fractured in a fall against the side of a boat, and came under my care in a situation where the ordinary apparatus used in such cases could not be procured. Indeed there was scarcely any thing else at command than a quantity of coarse canvass used for sails of vessels.

I marked upon a piece of this, of suitable size, the distance between the shoulders measured across the breast, and made openings for the arms, which were then passed through them. The ends of the canvass were then laced behind, in the manner of a corset, during a strong expiration. This apparatus soon put a period to the pain and difficulty of breathing which had been previously experienced, and enabled him to work without inconvenience. After wearing the corset about ten days, he thought proper to have it loosened; but he was soon taught the impropriety of this by a return of the pain in the place of fracture during inspiration.

The simple apparatus employed in this, answers the purpose quite as well as any other.

NOTE C, p. 101.

The difficulty of preventing the lower part of the limb from being turned outward, in pursuing treatment adopted by the English surgeons, appears to me almost insuperable.

As to Desault's apparatus, it has a tendency rather to increase than to diminish the disposition of the foot to turn outward, and occasion the deformity; because the bandage for the extension, attached above the ankle, passes by the sides of the foot, not directly downward in the direction of the axis of the leg, but obliquely downward and *outward* through the mortice of the long splint, on the outside of the leg. This inconvenience is completely obviated by passing one end of the band over a block attached to the lower end of the splint, according to the improvement of Drs. Physick and Hutchinson. Another great advantage of the apparatus employed by Dr. Physick is, that it diminishes the obliquity with which the band for counter-extension acts upon the pelvis in respect to the axis of the limb, thereby diminishing part of the unavoidable pressure upon the groin.

On the other hand, the pressure of the crutch or cushion at the upper end of the long splint, against the axilla, which is intended to take off some of the pressure against the pelvis, appears to me to be rather a defect than an advantage in Dr. P.'s apparatus. Let us suppose, for instance, the force of the counter-extension to be equal to twelve pounds: the force of the extension will also be equal to twelve pounds. Now, if any portion, say two pounds, of the counter-extension be supported by the axilla, and removed, of course, from the pelvis, so much of that assemblage of bones as is moveable, viz. the outer part, will be drawn down by a force equal to two pounds; and by the resistance of the acetabulum to the head of the femur it will be carried inwards; thus causing the fragments to form with each other a salient angle, toward the internal part of the thigh.

If there be any objection to M. Boyer's machine, other than the difficulty of measuring the degree of force with which it acts, it is that it is too complicated for private practice. We think the apparatus of Dr. Physick, without the crutch, the upper end of the long splint terminating opposite the lower end of the sternum, preferable, in most cases, to any other.

NOTE D, p. 149.

Future experience alone can determine the value of the following observations, which were extracted from a late publication on Diseases of the Spine, by Mr. Copeland, of London.

" In most cases, and particularly where the disease is in the usual place, the superior dorsal vertebræ, the great characteristic circumstance and symptom, is a commencing paralysis of the abdominal muscles. It is surprising how very early in the disease this symptom may be detected, when the attention is directed to it. It is sometimes described as an oppression of breathing, tightness of the stomach, band tied round the belly, torpor of the abdomen, and by other expressions, in different patients. It produces costiveness and retention of urine, in a more advanced stage: in short, in whatever of these symptoms you examine it, some function of the abdominal muscles is recognized to be impeded. No author, who has mentioned this disease, has omitted this symptom under some name or other, although it has never, I believe, been fully explained.

" I have seen it called asthma, and prescribed for as such for several months: it is often called dyspepsia, and even diseased liver, from the sense of uneasiness and stricture over the region of the liver and stomach: sometimes is taken for a disease of the colon or rectum, from the costiveness and pain that accompany it. The bladder also being unable to perform its office, the cause of this impediment is sought for in the uretha or kidneys."

" If the disease is in the *neck*, there will be pain and difficulty in the rotation and other motions of the head, and the oppressed breathing is one of the most strongly marked features. If the *back* is the seat of the disease, the oppression at the stomach, as it is called, or the torpor of the abdominal muscles, will be strongly marked. In the *bones*, both these indications are wanting, and the symptoms principally regard the bladder and rectum, whose offices are in a greater or less degree disturbed, according to the degree of pressure made on the nerves which supply them."

Mr. Copeland admits, however, that the actual seat of the disease in the spine is often determined with difficulty from these early symptoms alone; but the diagnosis is aided, in these cases, by an attention to two circumstances; namely, the greater sensibility to pressure, and to the stimulus of heat, but especially the former. This is to be ascertained by carefully examining, with the fingers, the whole spinal column, in which the smallest degree of tenderness may be deemed evidence of morbid action within. Where this is not easily ascertained, the susceptibility to the stimulus of heat will often detect the morbid part. Thus " a sponge, wrang out of hot water, and carried down the spine, will often give a very acute degree of pain while passing over the part where disease is going on." This the author discovered by accident, in sponging the bites of leeches over a diseased spine: but his subsequent observations have taught him that this peculiar sensibility is not quite uniform, though it is often an auxiliary in determining the diagnosis.

NOTE E, p. 150.

The opinion here stated with respect to the efficacy of *rest*, is that of the great body of well informed surgeons of the present day. But Mr. Baynton, of Bristol, whom we have had occasion to mention with respect in the former volume of this work, maintains a very different opinion. We shall give our readers a full view of his doctrine and practice in caries of the vertebræ, and leave to their judgment and experience to decide on its merits.

Mr. Baynton recommends rest in a horizontal position, which, he says, " is as effectual in improving circulation, favouring the deposition of bones, and promoting absorption, as it is in preventing pressure and allaying pain." In his early cases, the author conjoined with rest, the use of drains; in his later practice, he has not found them generally, if ever, necessary in the cure of diseases of the spine. In these cases, when a tonic remedy is indicated, he occasionally prescribes muriate of lime; but does not place great confidence in its alleged beneficial effects in scrofula. As rest is the chief means employed in the cure, it is essential that it should be obtained with the greatest ease to the patient, and that excoriation, and other inconveniences consequent on long confinements in bed, should be avoided. For these purposes the author suggests that

" A crib, or narrow bedstead, must be procured, six feet in length, or rather of a sufficient length to accommodate the patient; two feet one inch in height, from the floor of the apartment to the floor of the crib, where the mattress is placed; two feet five inches wide, with posts three feet seven inches high, containing castors, to be turned by a turner, as a common crib.

" It must be provided with a rail floor, instead of sacking, and with side boards to raise up and down, which, when half raised, will resemble the raised flap of a table, and must be supported with sliders, that can be drawn in or out when required, and which, when wholly raised, will furnish sides to the crib, for security, or warmth at night. The castors should be of brass, and of the strongest description.

" This crib is to be fitted with a mattress, from three to four inches thick, that has been French or double stuffed with the best horse hair, made two inches shorter and two inches narrower than the crib, in the clear of the sides, head and foot-board, for the purpose of affording room for raising the sides, and turning in the bed clothes. Its width will be sufficient for the accommodation of the patient, though its dimensions will admit of its being drawn through the door-ways of the patient's day and night apartments. Its height, when the mattress is laid upon it, will be just sufficient to raise the patient to the level of a common table."

By this means, the patient may be readily removed from one apartment to another, and thus have the advantage of changing the atmosphere, and enjoying the pleasure of society.

Mr. Baynton has annexed several cases which he treated with success. We attach so much respect to the author of " A new mode of curing Old Ulcers," that we are unwilling to omit inserting some of them, though our opinion is adverse to his practice.

" The friends of Miss ——, about sixteen or seventeen years old, re-
quested my attendance, at the village of Bishport, near Bristol, on the
5th of December, 1801.

" On my arrival, I was introduced to three young ladies, who were sit-
ing together in a parlour apartment, all apparently in good health, and
remarkably cheerful. The parent of the lady who was to become my pa-
tient asked me if I could discover the invalid ? On my replying in the ne-
gative, she told me that her daughter, whom she then pointed out to me,
was completely palsied by a disease of the spine, for which sea-bathing,
and a mechanical apparatus for the removal of pressure, had been a long
time used, without the slightest advantage.

"She also informed me, that her application had been made to me in
consequence of the recommendation of Mr. ——, a gentleman of the
most distinguished eminence in London, for the advantage of whose
opinion she had, by the advice of her physician, gone with her daughter
to London, and had just returned. Having, previously thereto, procured
a new set of mechanical apparatus, from a person, I believe, named
Jones, by the advice of the gentleman above alluded to.

" On examining the part, I found a considerable projection of two of
the dorsal vertebræ, and the contiguous parts in a very tender state.

" I also found that the sensibility of the legs, thighs, and other parts
below the diseased, was so completely destroyed, as to render it impos-
sible to excite the slightest sensation, by pinching, pricking, or any other
means.

" I considered it my duty to apprize the relations of this interesting and
very amiable young lady, that much time ought not to be employed in the
trial of this new apparatus, if relief were not experienced. It unfortu-
nately happened that a period of more than five months was employed
in its trial.

" On the 15th of the following May, 1803, I was requested again to see
this lady, and to adopt any means that I might consider to be likely to
afford any chance of recovery. By this time a remarkable change had
taken place. The cheerfulness and appearance of health, which, at my
first visit, had been so astonishingly preserved, as to occasion no percep-
tible difference between her and healthy companions, were entirely gone.
Her general appearance was now so unfavourable as to occasion me to fear
that her life could not be preserved until a trial could be given to the
means I intended to have recourse to.

" One point was gained by the apparently unfortunate state of circum-
stances. A determination had been made by the very anxious relatives, to
adopt, implicitly, any means that might be recommended.

" She was immediately placed on an unyielding mattress, without a pil-
low; setons were inserted on each side of the diseased vertebræ, and in-
structions were given, with the utmost care, that the lady should never
be raised from the horizontal position, or moved for any other than na-
tural purposes, or the dressing of the setons. A suitable regimen and
medicines, adapted to the varying circumstances of the case, were then
exhibited. The general health soon became improved; but it did not
happen until the eleventh month that any sensation was experienced in

the palsied parts. About that time, a tingling was felt in the legs; and from that time the recovery proceeded so rapidly, that at the end of the fifteenth month she could walk without inconvenience, and by the end of the eighteenth month, could run, leap, and dance as well as ever she could in her life.

" The protruded processes of the vertebræ continued to project, in consequence of the occurrence of anchylosis previously to the adoption of recumbency.

" I have had frequent opportunities of hearing from this lady and her friends, that no tendency to relapse, nor any inconvenience, has been experienced since the completion of her cure, a period of nearly ten years.

" On the 17th of April, 1811, I was consulted by the friends of Miss ——, aged 15, on account of a disease of the spine, for which setons had been recommended. Upon examination a slight curvature was observed, and on pressing the processes, it was observed by the tenderness, that some of the dorsal vertebræ were in an inflamed state. Absolute rest, in the manner described, was therefore recommended; and as the general appearance indicated that a tonic remedy was necessary, the muriate of lime was ordered. No material affection of the parts below the diseased had occurred, nor had the general health been much impaired.

" I did not see this lady a second time. She was removed to the country, and the directions observed there. A perfect cure was obtained in six or seven months; of the exact time I am not certain.

" Master W. Castle, son of Mr. Thomas Castle, of Portland-Square, Bristol, when about one year old, was observed to have lost his health, when it was observed he could not use his legs as he had been accustomed to do. On examining the spine I discovered that four of the lower dorsal vertebræ were in a diseased and protruded state, and that great pain was occasioned by moderate compression, either of the bones or cartilaginous soft parts. Absolute rest, on a hair mattress, was strictly enjoined; the muriate of lime, in appropriate doses, directed, and the constant care of a confidential servant ensured. The advantages resulting from these means were soon apparent. They continued progressively to increase until the cure was accomplished. At the end of the sixth month, he was allowed to roll and play on a carpet. In a short time after, he got on his feet without assistance, and has continued in perfect health from that time to the present. The curve is entirely removed."

NOTE F, p. 214.

The success of the following extraordinary case of reduction of a dislocation of the humerus of more than five months standing, does not appear to be attributable to any of the causes mentioned by Baron Boyer.

We insert it not less with a view of recording a remarkable fact very creditable to Dr. M'Kenzie than to state our opinion of the great efficacy of bloodletting ad deliquium animi, in facilitating the reduction of dislocations.

Dr. Physick is believed to be the first who fully established the advant-age of this practice. The case alluded to was communicated to him in a letter from Dr. M'Kenzie, of which the following is an extract.

" J. B. a seaman, aged about thirty-five years, was admitted into the Bal-timore hospital in the month of September, 1805, with a luxation of the os humeri. The account he gave of his case was, that while on a voyage to Liverpool, and two weeks after leaving this port, he fell from a consi-derable height, and dislocated his shoulder, and that an attempt was made by the captain of the ship to reduce it, but without success; that upon his arrival at Liverpool repeated trials were made to effect reduction of the bone, but to no purpose, and he had now remained in this situation *between five and six months.*

"Upon examining the shoulder, I found the head of the humerus un-der the pectoral muscles, where it had imbedded itself, and appeared to have formed considerable connexion with the surrounding parts.

" In this state of things I deferred any attempt to reduce the bone till the following day, when, in consultation with my friend Dr. Smyth, it was determined at once to have recourse to bleeding ad deliquiem, as the only plan, in our view, likely to succeed; and, having secured our pa-tient in the usual manner, a vein was opened, and nearly *five pounds of blood* were drawn before fainting could be produced; this, however, was at length completely effected, and with (comparatively speaking) very little effort, the bone was reduced.

" It is worthy of remark, in this case, that neither swelling nor inflam-mation succeeded the reduction of the bone, and the poor man was dis-missed well in the course of two weeks."

NOTE G, p. 238,

I have seen a case in which the cartilage of the sixth rib was luxated, after severe pneumonic inflammation, terminating in suppuration. After long-continued blistering, not only the matter, but a large portion of the right lobe of the lungs was absorbed. The right side of the thorax con-sequently sunk in, and the cartilage of the sixth rib projected beyond, and lapped over those of the seventh and fifth.

M. Larrey relates several interesting cases in which deformities occurred in a similar way. Dr. De la Motta has also recorded one in the second number of the New-York Medical Journal, published by Drs. Mott and Onderdonk.


NOTE H, p. 286.

Mr. Bloomfield was also foiled in an attempt to reduce a dislocation of the thumb, and the difficulty of effecting the reduction, in some cases is now acknowledged. It does not depend exclusively upon the causes

stated by Baron Boyer. Such at least is the opinion of Mr. Hey, of Leeds, of Mr. Charles Bell, and others.

Mr. Hey conceives that the lateral ligaments prevent the reduction, by confining the head of the first phalanx behind that of the metacarpal bone. Mr. C. Bell proposes to introduce a couching needle obliquely under the integuments, and to divide these ligaments, and advises that the thumb should be bent at the dislocated joint, so as to carry the head of the bone which is dislocated, in a semicircular line, around the head of the metacarpal bone.

The following cut illustrates his idea.
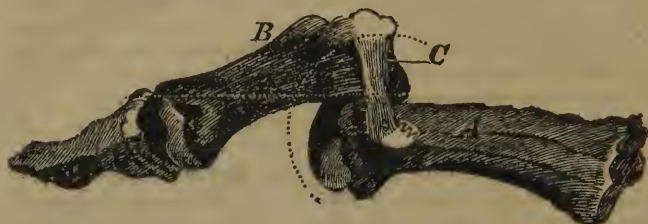
A represents the metacarpal bone of the thumb; *B* the first phalanx of the thumb dislocated; *C* the lateral ligament. It is easy to see that the contiguous parts of the bones *B* and *A* are locked together, and that the extension ought to be made in the direction of the semicircular line.

I do not know if the plan of dividing one of the lateral ligaments has ever been carried into effect. It appears preferable, however, to leaving the luxation unreduced, or using so much force as to endanger the tearing of the thumb, an accident which is said to have happened.

NOTE I, p. 308.

We think M. Veyret would have proceeded with much more ease to himself, if he had taken hold of the patient's right heel with his *right* hand, and pushed the patella into its place with his left.

NOTE J, p. 350.

Mr. Samuel Cooper, the author of the "Dictionary of Practical Surgery," &c. contends that the ends of the bones are not enlarged, even in cases of scrofulous white swelling.

"Deceived," he says, "by the feel of many diseased joints, and influenced by general opinion, I once imbibed the idea, that there is very frequently a regular expansion of the heads of scrofulous bones. But, ex-

cepting an occasional enlargement, which arises from spiculæ of bony matter deposited on the outside of the tibia, ulna, &c. and which alteration cannot be called an expansion of those bones, I have never been an eye-witness of the head of a bone being of preternaturally large dimensions, in consequence of the disease known by the name of white swelling. I have often been in the habit of inspecting the state of the numerous diseased joints which are every year amputated at St. Bartholomew's Hospital, and though I have long been attentive to this point, my searches after a really enlarged scrofulous bone have always been in vain. The change which the head of the tibia undergoes, in many cases, is first a partial absorption of the phosphate of lime throughout its texture, while a soft kind of matter seems to be secreted into its substance. In a more advanced stage, and, indeed, in that stage which most frequently takes place before a joint is amputated, the head of the bone has deep excavations, in consequence of caries, and its structure is now so softened, that when an instrument is pushed against the carious part, it easily penetrates deeply into the bone.

" A cursory examination of a diseased joint, even when it is cut open, will not suffice to show that the heads of the bones have not acquired an increase of size. In making a dissection of this kind, in the presence of a medical friend, I found, that, even after the joint had been opened, the swelling had every appearance of arising from an actual expansion of the bones. The gentleman with me felt the ends of the bones after the integuments had been removed, and he coincided with me, that the feel, which was even now communicated, seemed to be caused by a swelling of the bones themselves. But, on cleaning them, the enlargement was demonstrated to arise entirely from a thickening of the soft parts."

THE END